AUGUST, 1953

DIESEL POWER

AND DIESEL TRANSPORTATION

HOW THE RIGHT REDUCES

● The type, size and speed of your Diesels, the conditions under which they operate, and the fuel used — *all* these factors are considered by your Texaco Lubrication Engineer when he recommends the most suitable lubricating oil.

And because Texaco makes *a complete line* of Diesel lubricating oils — the *Texaco Ursa Oil* series — your Texaco Lubrication Engineeer can assure you an oil that is *exactly right* for your engines and the fuel you use.

This will mean more efficient operation, cleaner engines, minimum wear, reduced maintenance costs and less fuel consumption.

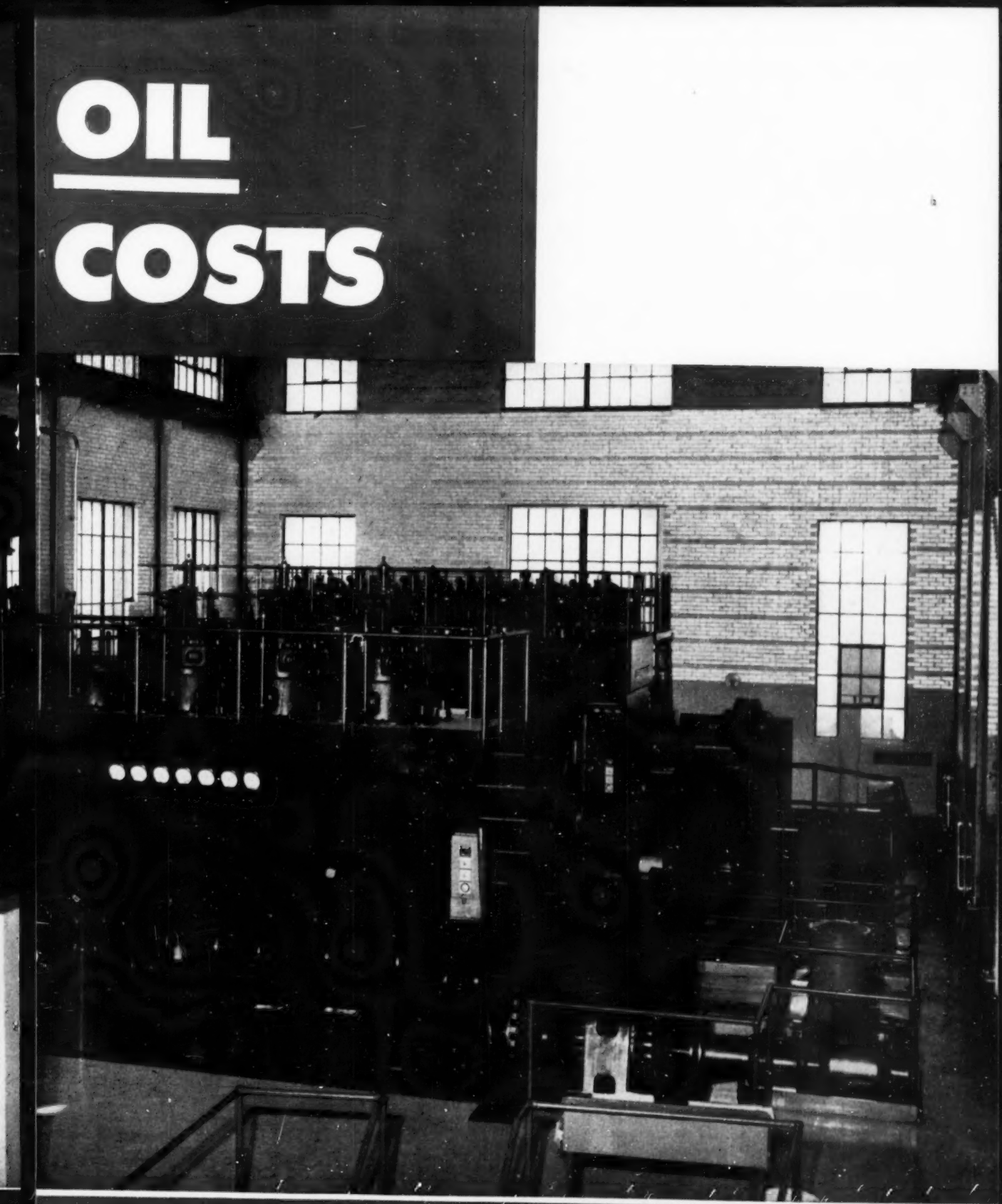
Call in a Texaco Lubrication Engineer today. Let him help you select the exact *Texaco Ursa Oil* to give you the most efficient performance. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N.Y.

TEXACO

REG. T.M.

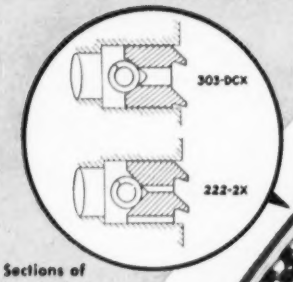
TEXACO

OIL COSTS



URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

Why COOK "SUPER-FLEX" OIL CONTROL RINGS *reduce lube-oil consumption*



Sections of two typical rings.

Coil peripherial compression type expander, contained by the ring, simplifies application—fits existing grooves.

Straight-line oil flow, unrestricted by expander, assures maximum drainage.

Flexible ring section assures cylinder contact at all points—provides uniform and positive wiping action.

Tension is adjustable by inserting washers here.

Spring wire of rectangular cross-section gives expander stability—reduces localized stresses—assures uniform tension.

Ring and Expander Spring "float" in groove—cylinder contact is undisturbed by piston "slap".

Expander never touches groove lands or bottom—preventing damage to groove and expander.

COOK "SUPER-FLEX" OIL CONTROL RINGS

conform to cylinder distortion and at the same time provide uniform wiping all the way around the cylinder.

Available in many styles to meet varying engine conditions, these outstanding rings materially reduce lube-oil consumption and maintain their efficiency throughout ring life.

WRITE FOR FULL INFORMATION

on Cook "Super-Flex" rings or for recommendations "job-engineered" to your specific engine requirements.

C. LEE COOK MFG. CO., INCORPORATED
Dept. 2, Louisville 3, Ky.
Representatives in principal industrial cities

COOK
PISTON RINGS

. . . SEALING PRESSURES SINCE 1888 . . .

DIESEL POWER
AND DIESEL TRANSPORTATION

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C. W. Kinnear, *Special Railroad Representative*
John H. Wetherell Jr., *Associate Editor*
Sylvia Zegar, *Editorial Assistant*

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August, 1953

Vol. 31, No. 8

Cover Photo: Cat D6 tractor-dozer being used to reclaim salt from stockpiles. Thought it was snow in August, didn't you.

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Cooper-Bessemer's Free Piston Engine 42
This newly developed engine provides a source of hot gases for turning a gas turbine, with extremely high overall thermal efficiency.

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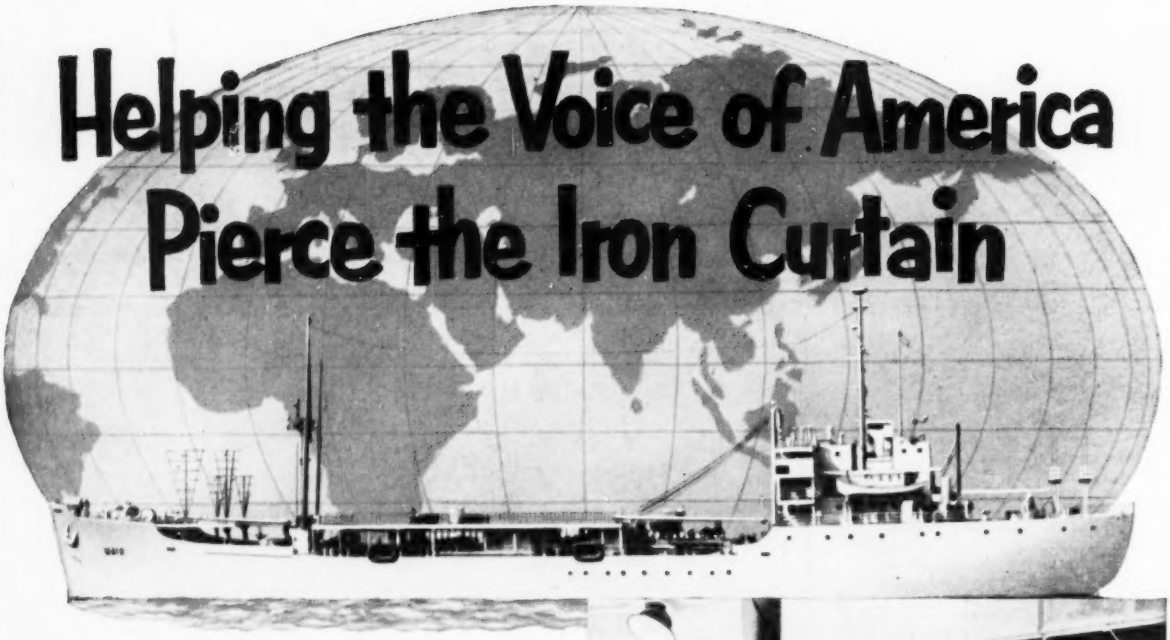
Application for Re-entry at Kutztown Pa is pending.

Helping the Voice of America Pierce the Iron Curtain



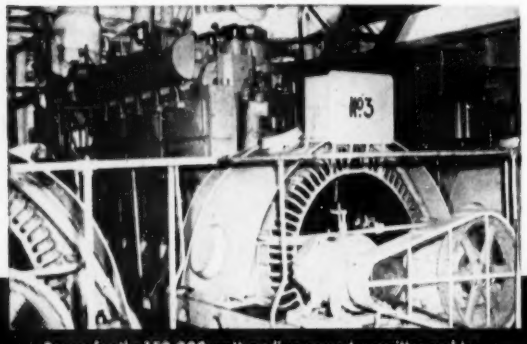
In a separate new auxiliary engine room, on the U.S. Coast Guard Cutter *Courier*, three 725 h.p. Enterprise diesels with Bendix* Fuel Injection equipment are playing an important part in helping to fight the cold war.

For this is the power plant that helps to transmit the Voice of America through the Iron Curtain to the captive peoples of the world.

To provide the electric power for the big transmitters, generating facilities must be capable of carrying difficult, variable loads with unvarying frequency, efficiently and dependably. Furthermore, the Enterprise diesels must continue to operate even if no better oil is available than residual fuel.

To help accomplish this important yet difficult task, Bendix Fuel Injection equipment was selected. In fact, wherever unusual performance standards are required, there is no better choice in fuel injection equipment than Bendix for complete dependability. *REG. U.S. PAT. OFF.

Main transmitter room from which programs can be initiated or Voice of America broadcasts from land based points can be relayed out again with greatly amplified range and power.



Power for the 150,000 watt medium wave transmitter and two 35,000 watt short wave transmitters is supplied by three Enterprise diesel engines with Bendix Fuel Injection equipment.

SCINTILLA MAGNETO DIVISION of

Bendix
AVIATION CORPORATION

SIDNEY, NEW YORK

Western Office: 582 Market Street, San Francisco, Calif.
Export Sales: Bendix International Division, 205 East 42nd St., New York 17, N. Y.

The Best Head is a Ground Head

. . . and that's why your best bet is the

New No. 562 VAN NORMAN Head Grinder

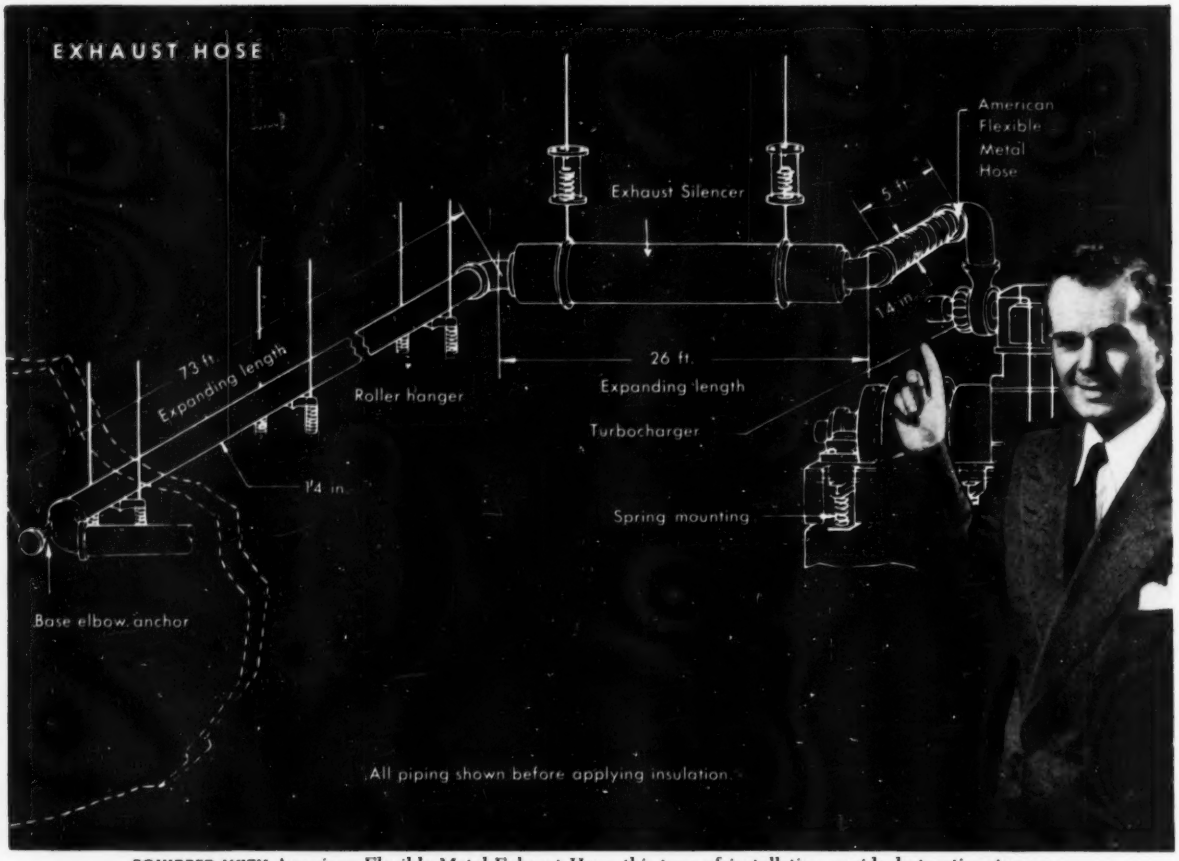
Here's the *"One-Man Machine Shop"* that does away with dust . . . fatigue . . . operator-errors.

This new high speed automatic machine wet-grinds "in-line" and "VEE" blocks exactly parallel to the crankshaft. It also grinds manifolds. Finish is uniformly even for proper gasket seal. And the operator has the easiest, most fool-proof grinding job he ever had.

New No. 562 has plenty of power . . . 5 HP wheelhead motor, 1725 R. P. M. Automatic feed, 48" per minute. Capacity: 46" long x 14" wide. Here's a fast, modern, precision machine-shop service you can really sell to all types of accounts. See your jobber *NOW*, or write: Van Norman Co., Springfield 7, Mass.

GET IT FROM YOUR JOBBER

The Best-Equipped Shop Gets the Business! that's why ***"It Pays to Van Normanize"***



EQUIPPED WITH American Flexible Metal Exhaust Hose, this type of installation avoids destructive stresses.

Exhaust system for a spring-mounted diesel

Here, flexible steel exhaust hose takes up expansion in the piping . . . isolates engine vibration . . . makes maintenance easier

Shown above is one method of arranging exhaust piping for a spring-mounted diesel engine. Notice that the exhaust system includes a flexible connection and is suspended on spring rollers. In this type of installation, flexible steel exhaust hose does 3 jobs:

(1) *It frees the engine turbocharger casing from strains caused by the expansion in two directions of the long exhaust line.*

(2) *It reduces the transmission of vibration caused by the oscillation of the engine on its spring mounting.*

(3) *It simplifies disassembly of the turbocharger.*

To these and other problems involved in installing exhaust piping, American Flexible Steel Exhaust Hose offers an easy solution. Because it is *flexible*, it "gives" when vibrations occur and when temperature changes expand and contract piping.

This hose can prevent expensive breakdowns which result when rigid piping systems "work" and overstress flange bolts. It relieves strain on engine castings . . . keeps exhaust lines tight. Offset connections and misalignment are easily solved. Installation is quick and economical. No costly pipe bends are needed. Once this hose is installed, you're sure of years of trouble-free service.

American Flexible Steel Exhaust Hose for exhaust and air intake—marine or industrial diesels—is available in corrugated steel, 2 in. to 16 in. I.D. inclusive. Want more information? Write for Bulletin EH-50-1 to: *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Ltd.*

53232

OTHER PRODUCTS FOR DIESEL USE: Flexible tubing with wire braid covering for: starting air, circulating water, fuel oil, lubricating oil. Tubing available in bronze, carbon and stainless steel. Assemblies complete with fittings.

WHEREVER CONNECTORS MUST MOVE

AMERICAN

flexible metal hose and tubing

An ANACONDA® Product

GM DIESEL
CASE HISTORY NO. 1A3-12

OWNER: Georgia Coating Clay Co., Macon, Ga.

INSTALLATION: Twelve GM Diesels power shovels, Koehring Dumptors, GMC Trucks stripping 97 feet of overburden and mining Kaolin.

PERFORMANCE: Equip. Supt. W. J. Herrington reports 6-71 powering Koehring 1½-yd. shovel (background) has worked 45 hours a week, 52 weeks a year for over 6 years--about 14,000 hours--without an overhaul. Newer ¾-yd. Lima (foreground), powered by a 3-71, has already operated for 3500 trouble-free hours.

GM
GENERAL MOTORS
DIESEL
POWER

14,000 HOURS
WITHOUT ENGINE OVERHAUL

Long engine life between overhauls is only one advantage you get with General Motors Diesel engines. Power on every piston downstroke makes a 2-cycle GM Diesel accelerate faster under load—gets more work done every hour. Simple, practical design cuts down time because it does away with such trouble sources as high pressure fuel lines. When service is needed, you'll find the cost surprisingly low. GM Diesel engines are easy to work on—simple to inspect and service. And comparison will show you that GM Diesel parts cost less.

You can get GM Diesel power in leading makes of shovels, tractors, hauling units, loaders, compressors and generators. A postcard will bring you a list of the 750 different models of equipment powered by General Motors Diesel engines.

DETROIT DIESEL ENGINE DIVISION

GENERAL MOTORS • DETROIT 28, MICHIGAN
Single Engines . . . 16 to 275 H.P. Multiple Units . . . Up to 840 H.P.

THE ENGINEER'S REPORT

DATA

LUBRICANT RPM Delo Oils

UNIT 8 cyl. 165 H.P. gasoline engine

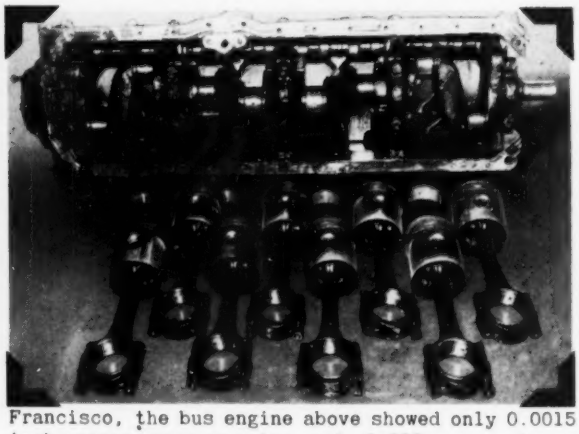
SERVICE Suburban bus

CONDITIONS Many traffic stops, cold engines, heavy pulls on hills

FIRM The Gray Line, Inc. of San Francisco

Over 83,000 stop-and-go miles before overhaul!

RPM DELO SPECIAL LUBRICATING OIL cuts operating costs by keeping engines clean and reducing wear in more than 400 busses and cars operated in the San Francisco Bay area by The Gray Line, Inc. Overhauled for the first time after 83,579 miles in hilly San Francisco, the bus engine above showed only 0.0015 inch average wear on mains, only 0.009 average taper in cylinders...despite a heavy-traffic run, many stops.



NO STUCK OR BROKEN RINGS were found on any of the eight pistons. Con-rod bearings were unscored and piston walls lacquer-free, as this photo shows.

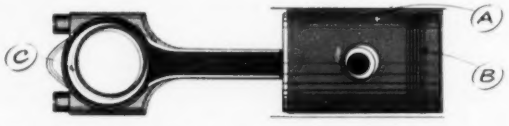
REMARKS: Besides "Sightseers," Gray Line operates an airport limousine service, charter busses, chauffered limousines and U-drive cars. Mr. P. J. McNamee, Mgr. of Operations, says, "RPM DELO Oil has reduced operating costs greatly by keeping our engines clean and reducing wear." There is an RPM DELO Oil to meet every heavy-duty engine operating condition.

FREE BOOKLET on the RPM DELO Oils gives you complete information. Write or ask for it today.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

How RPM DELO Oils keep engines clean and prevent wear



A. Contain special additives that provide metal-adhesion qualities...protect parts whether hot or cold, running or idle.

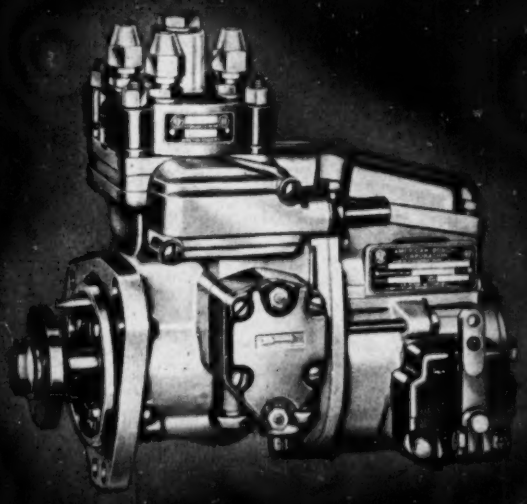
B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean...helps prevent piston scuffing.

C. Special compounds stop corrosion of any bearing metal and foaming in crankcase.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

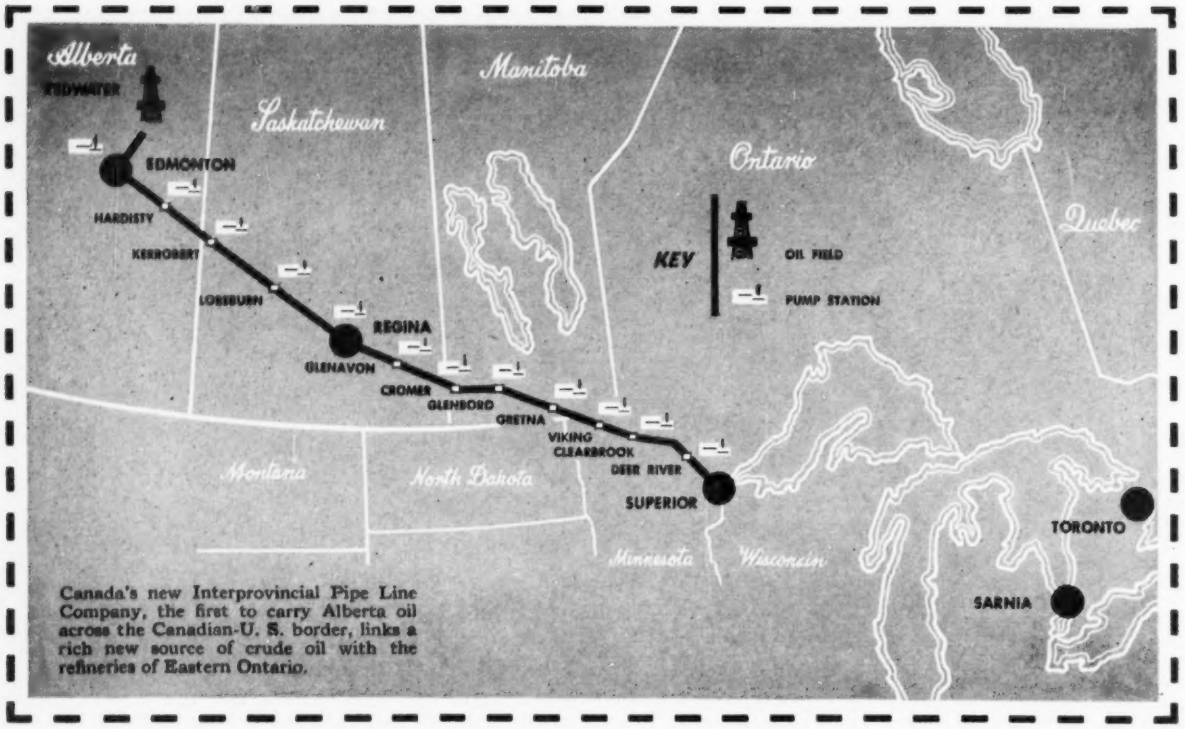
STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Barber, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

greatest single advance in diesel fuel injection...



AMERICAN BOSCH

American Bosch single-plunger multi-cylinder pumps have literally revolutionized the concepts of diesel fuel injection.



Canada's new Interprovincial Pipe Line Company, the first to carry Alberta oil across the Canadian-U. S. border, links a rich new source of crude oil with the refineries of Eastern Ontario.

Alco Diesel Engines Pump Alberta Oil 1137 miles to U.S. Port on Great Lakes

Canada's new 1137-mile Interprovincial Pipe Line and its American Subsidiary, Lakehead Pipe Line Company, Inc., offer an outstanding example of international teamwork—and open a new era in the history of Canadian petroleum.

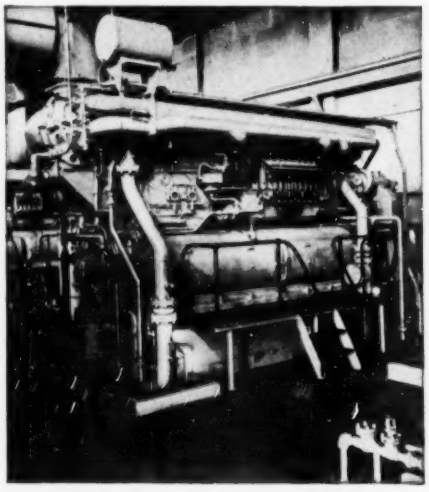
Served by Alco Diesel Engines, this first major Canadian pipeline (approximate annual capacity: 58.5 million barrels out of Edmonton) carries crude oil from the rich fields of central Alberta to the strategically located Great Lakes port of Superior, Wisconsin, from where it is transported to the refineries of Eastern Ontario.

Nine of the line's twelve pumping stations are located in Canada, three in the U. S. (see map). Each is powered by either two, three or four Alco Diesel Engines. Units for the Canadian stations were built under Alco license by the Dominion Engineering Works of Montreal; U. S. units were built in Alco's diesel plant at Auburn, N. Y.

Some of these 12½ in. x 13 in. engines have six cylinders and others, eight. Some are straight diesel and others are dual fuel. All of the engines are suitable for burning available crude oil.

The new Interprovincial Pipe Line is just one more major installation where the compactness, efficiency and flexibility of Alco Diesel Engines are helping to meet the free world's growing demand for petroleum products.

Your nearest Alco sales representative will be happy to give you detailed information on Alco Diesel Engines. Contact him at New York, Beaumont, Chicago, Cleveland, Houston, Kansas City, San Francisco, Schenectady or St. Louis.



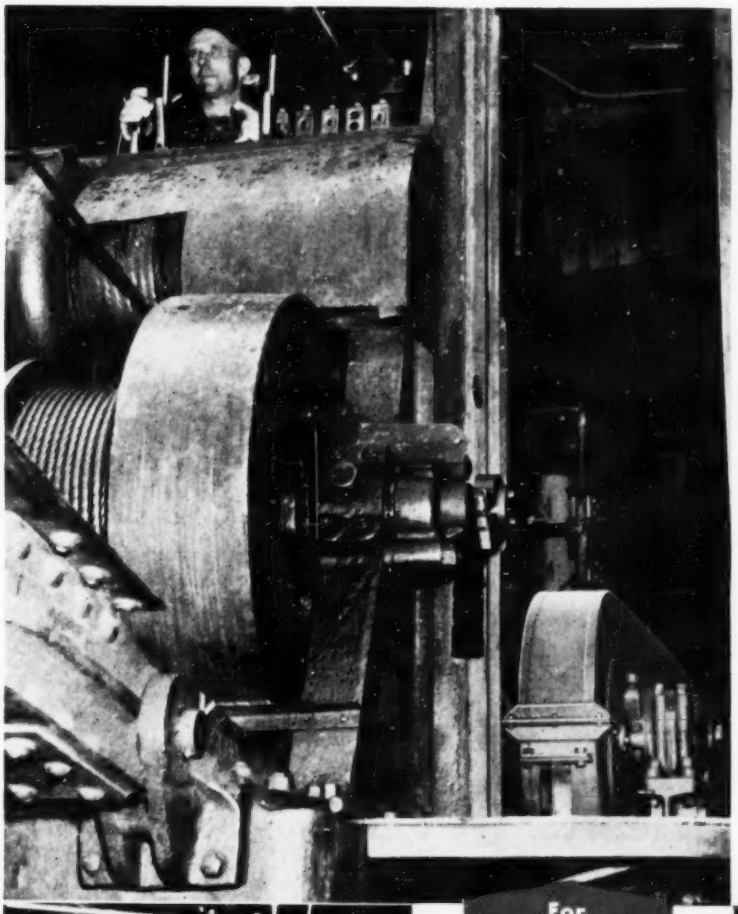
Eight cylinder, 12½ in. x 13 in. Alco dual-fuel Diesel Engine, manufactured in Canada by Dominion Engineering Works, Montreal, shown in engine room of the Interprovincial's Edmonton, Alberta, pumping station.

ALCO DIESELS

AMERICAN LOCOMOTIVE COMPANY
SCHENECTADY, N. Y.

The mark of modern engineering

Why it pays to choose diesel auxiliary drives from LINK-BELT's complete chain line



LINK-BELT offers you the right chain for your drive requirements

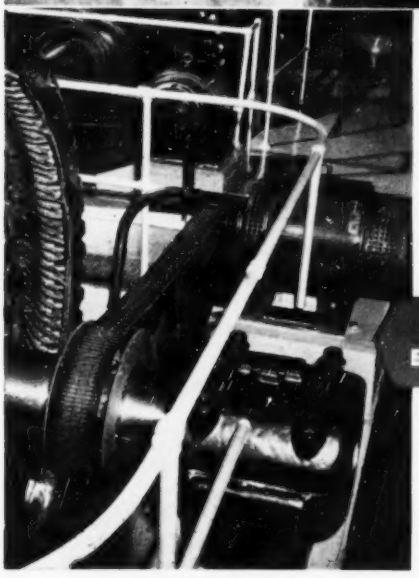
Whether it's a conversion, exciter, power take-off or any other auxiliary drive—there's a Link-Belt chain that meets the specific demands of each type of diesel service. You get the *one* chain that gives you the most economical power transmission . . . efficiently . . . at proper speeds.

That's why—if you plan to utilize diesel power in any way—you'll find it pays to call in a Link-Belt power transmission engineer. Working with a complete line and backed by Link-Belt's broad experience, he can recommend the drive that best meets your exact requirements.

LINK-BELT

CHAIN DRIVES

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 13,098

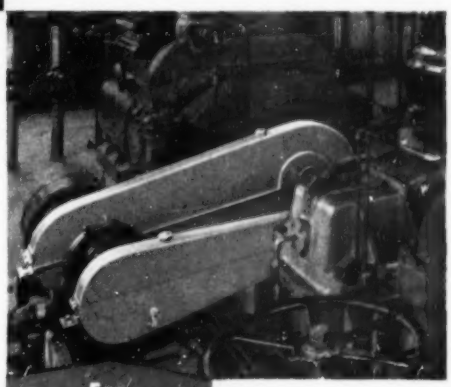


For Conversion

In converting this 1916 steam-operated locomotive crane to diesel power, Link-Belt Silverstreak Silent Chain was chosen as the drive. It provides positive, tooth-to-tooth action with the assurance of years of continuous, economical service.

For Exciter Drives

Full exciter rpm is transmitted by this Link-Belt Silverstreak Silent Chain drive. Chain meshes with sprocket teeth—no possibility of slippage.



For Power Take-off

Link-Belt Silverstreak Silent Chain provides the drives from diesel engines to pumps at pipeline booster station.

Eaton Diesel Engine Valves, Bolts, and Studs

Produced to meet the exacting requirements of Diesel Engine Service

A background of many years of experience as suppliers to the Diesel engine industry gives Eaton a thorough understanding of the peculiar problems encountered in this highly specialized field. Eaton has made far-reaching engineering contributions applicable to practically all types and sizes of Diesel engines. Greatly enlarged manufacturing facilities permit the production of highly-stressed main-bearing and connecting rod bolts with forged heads, under strict metallurgical and quality control.

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EARLY 19TH CENTURY SAWMILL IN EAST TOPSHAM, VERMONT

100-HORSE DIESEL, powered and lubricated with Cities Service Products, is the power plant for Miller's operation.

Industrial Giant?

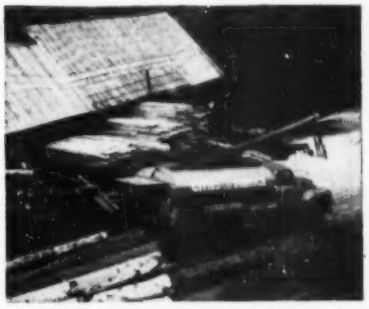
No, Duncan Miller, Vermont logger (pictured left), is no industrial giant, but his power and lubrication needs are just as vital, and served just as assiduously by Cities Service. Cities Service is proud of its long and successful record serving America's top industrial organizations, but it is equally proud of its record with the "Duncan Millers."

Says Duncan Miller: "I produce some 600,000 board feet of lumber a year. My 100-horse diesel drives all my equipment. I use Cities Service Diesel Fuel because it gives me all the power I need and burns so cleanly to provide easier equipment maintenance.

"In my trucks, tractors, chain saw and sawmill, I use Triple HD Koolmotor Oil. I even use Koolmotor in my high speed bearings that carry heavy loads . . . and Koolmotor has done every job with complete satisfaction for me.

"I also use Cities Service Gasolene in my trucks, tractors and chain saw. I heartily recommend it where a lot of power and economy of operation are needed."

You don't have to be a sawmill operator to realize the value of Cities Service one-source buying for the finest, most economical power and lubrication, and the services of our expert Lubrication Engineers!



FOR SEVEN YEARS, Miller has used only Cities Service Products and *"They have given best results at all times."*

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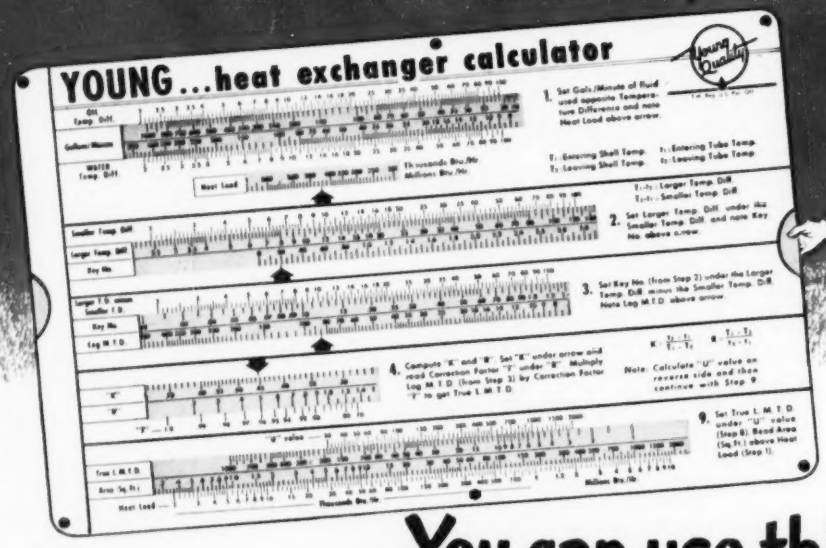
QUALITY PETROLEUM PRODUCTS

If You Specify Heat Exchangers...



...You can use this

NEW YOUNG HEAT EXCHANGER CALCULATOR

AN EASY WAY TO SELECT THE CORRECT UNIT FOR YOUR JOB
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This exclusive Young Heat Exchanger Calculator is an engineering tool specially designed to help you calculate and specify Young shell and tube Heat Exchangers. Designed to save you time, the Calculator enables an engineer to determine quickly individual heat transfer coefficients for the shell side and tube side, and by combining them with suitable fouling factors to determine over-all heat transfer coefficients. It also gives you a visual picture how the size of a Heat Exchanger will vary with fluid temperatures and velocities.

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Device Engineering
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Southern Company, Inc.
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TEXAS
Hydraquip Corp.
6645 Navigation Blvd.
Houston, Tex.

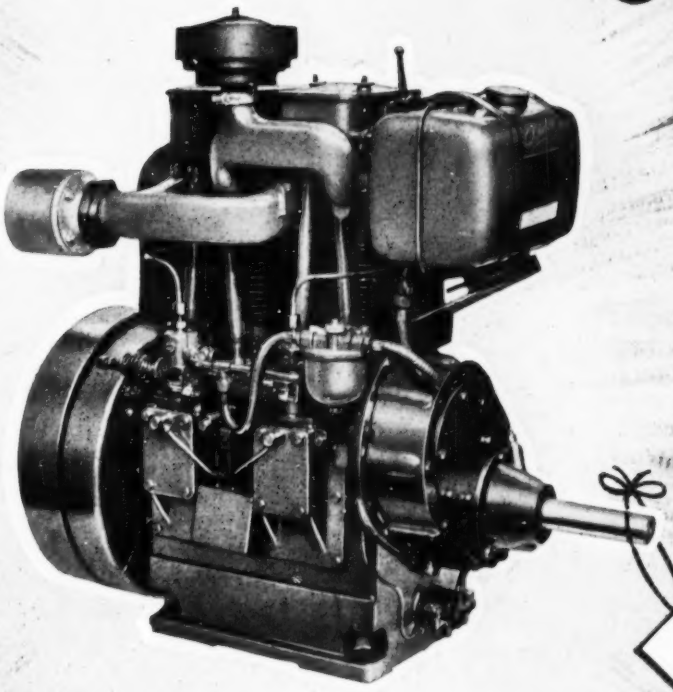
UTAH
Robert Taylor & Sons
P. O. Box 1223, 1077 Main St.
Salt Lake City, Utah

WASHINGTON
John F. Gertz Co.
3242 Eastlake Ave., Seattle, Wash.

Petter

Diesel Engines

AIR-COOLED
WATER-COOLED
3 H.P. TO 40 H.P.



LOW COST

BACKED BY A WORLD-WIDE
PARTS AND SERVICE ORGANISATION
FOR THE 350,000 ENGINES IN USE

- MARINE AUXILIARIES
- GENERATORS
- PUMPING EQUIPMENT
- COMPRESSORS
- REFRIGERATION
- OIL FIELD EQUIPMENT
- MINING EQUIPMENT
- AGRICULTURAL MACHINERY

WRITE FOR INFORMATION

A FEW CHOICE DISTRIBUTORSHIPS OPEN

PETTER

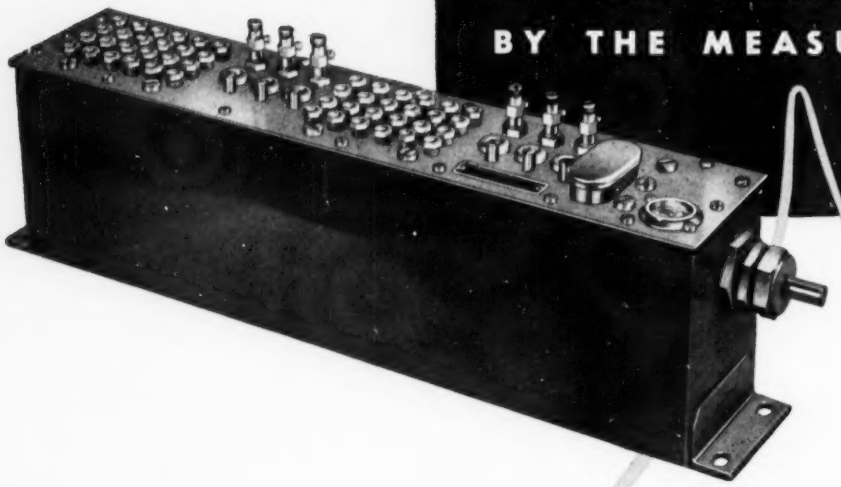
ENGINE DIVISION OF BRUSH ABOE INC.

Office and Showroom 80-01 38th AVE., WOODSIDE, NEW YORK

MADISON-KIPP

Fresh Oil

. . . FED UNDER PRESSURE BY THE MEASURED DROP



the most dependable method of lubrication ever developed!

This lubricator becomes an integral part of a machine tool in which there are 48 vital bearings that require dependable lubrication. The Madison-Kipp mechanism is so compact that the reservoir measurements are only 4" wide, 19¾" long by 5¾ high."

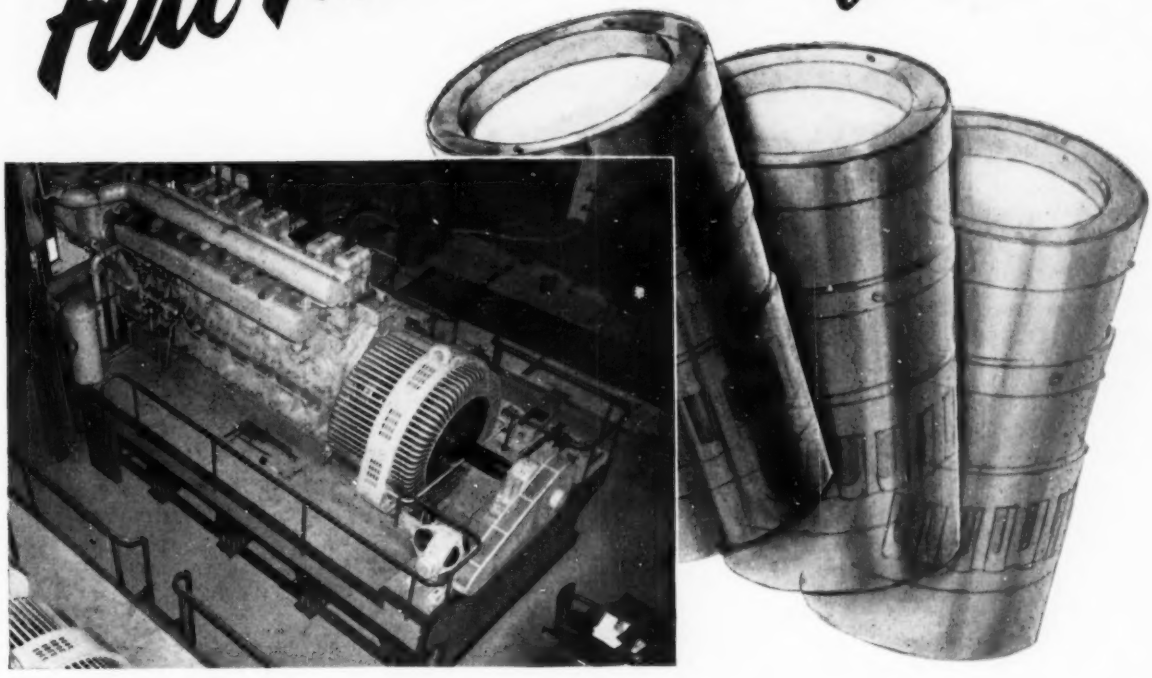
There are six different models to meet almost every application requirement. Please write us for all details regarding your particular lubricator requirements.

MADISON-KIPP CORPORATION
205 WAUBESA STREET • MADISON 10, WISCONSIN

kipp

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

Full-Throttle Profit...



Want to open the throttle for more profit? Then throttle back on Diesel operating costs — by using Van der Horst processing.

It gives you a flexible advantage. With VANDERLOY M, we renew worn liners — even those that oversize 0.001-inch per inch of diameter. Finished to original dimensions with PORUS-KROME*, they'll take twice the punishment raw liners can stand.

Yet, as compared to buying new ones, these Van der Horst liners save you money!

Use them to boost the power factor without increase in cost, or take the profit on their higher efficiency and much longer service life — whichever way fits best in your operating pattern.

Diesel owners everywhere find PORUS-KROME out-wears two or more raw liners. Rings stand up proportionately longer, against this unique plated service. And both fuel and lube oil consumption are reduced.

You might as well have this advantage. Cut out the cumulative cost of oversizing and use only standard size parts. Once you've tried it, you'll find Van der Horst processing is the way to full-throttle profit. We'd like to show you, in actual figures.

W53-D6

VAN DER HORST

* *PORUS-KROME is a dense, hard, wear and corrosion-resistant chromium, produced by the Van der Horst Corporation of America, and which gives working surfaces an infinite number of tiny oil-retaining reservoirs for perfected lubrication.*

U. S. PATENTS
2,048,578, 2,314,604 and 2,412,698

VAN DER HORST CORPORATION • OLEAN, N. Y.

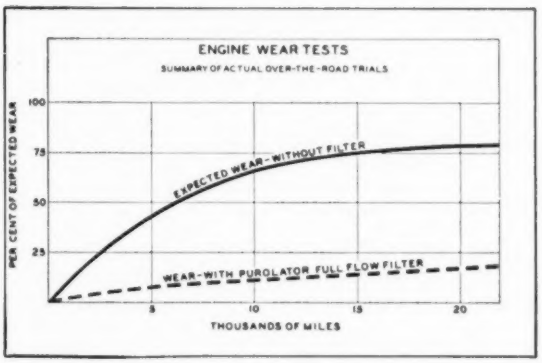
Again... proved BEST!

Over-all engine wear REDUCED.... 78%
Ring wear REDUCED..... 33%
in over-the-road tests with

PUROLATOR
FULL-FLOW
MICRONIC FILTERS

In test after test, America's leading automotive and engine manufacturers are proving that Purolator oil filters are the best!

The figures you see above are from engineering records compiled by one of the world's largest makers of passenger cars and trucks. They are the results of gruelling *actual-service* tests made to compare the performance of various makes and types of lube oil filters. And, like so many other important ones, this manufacturer found that Purolator*, *and only Purolator,* oil filters gave them the engine-saving performance they were seeking. They found that Purolator Full-Flow filtration was better by far than *any* partial flow system . . . that the Purolator Micronic* Filter element gave finer filtration, with longer life, at lower pressures than any other tested.



There are sound reasons for the Purolator Micronic Filter Element's outstanding superiority! It is the *only* element capable of delivering full-flow rates during its entire service life, *with dependable filtration down to submicrons* (.0000039 in.)! It has *ten times* the effective filtering area of old-style filters.

If you are a maker or user of internal combustion engines, you are invited to test and *compare* Purolator performance for yourself. Our Engineering Department will gladly co-operate in helping you prove to your own satisfaction *that there is no other oil filter capable of giving you better engine protection than Purolator. Simply write, telling us what equipment you are using.* *Reg. U. S. Pat. Off.

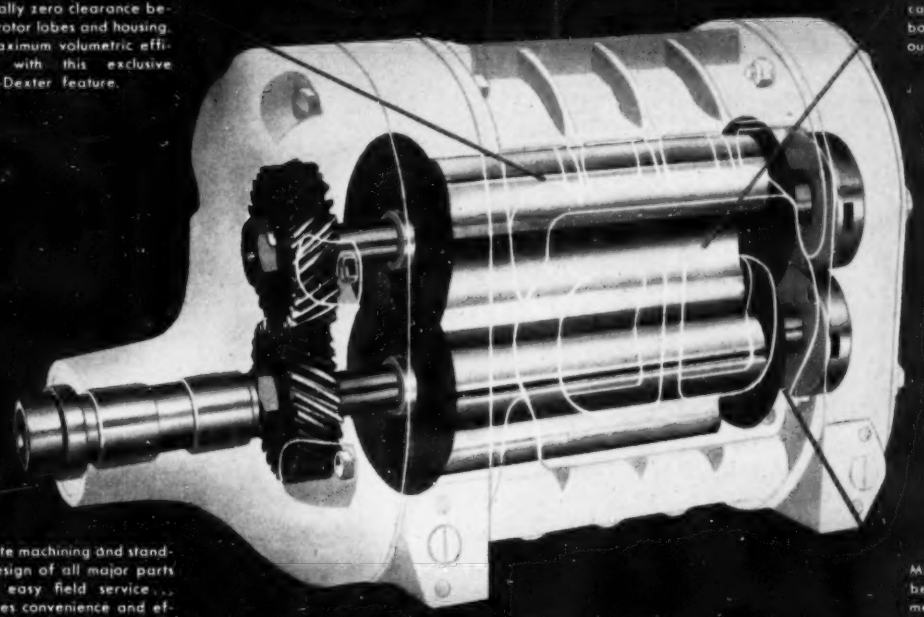
PUROLATOR PRODUCTS, INC.
Rahway, New Jersey and Toronto, Ontario, Canada
Factory Branch Offices:
Chicago, Detroit, Los Angeles

PUROLATOR
MICRONIC OIL FILTER
"FIRST IN THE FIELD OF FILTERING"

only MIEHLE-DEXTER superchargers give you these 4 big engineering advantages

Formica wear strips are locked into rotor lobes . . . provide practically zero clearance between rotor lobes and housing. Get maximum volumetric efficiency with this exclusive Miehle-Dexter feature.

Here's a big plus . . . lightweight aluminum rotors and case. Little wonder up to 50% bonus power is available without penalty of added weight.



Accurate machining and standard design of all major parts allows easy field service . . . improves convenience and efficiency. Parts from one unit can be field installed in another of the same type.

Miehle-Dexter's patented rubber grid seal, vulcanized to metal end plates, eliminates metal-to-metal contact . . . assures long service life and achieves fuel savings.

and add up to 50% more engine horsepower for all these applications too!

TRACTORS

CONSTRUCTION EQUIPMENT

LOCOMOTIVES

BUSES

MARINE

TRUCKS

STATIONARY PLANTS

The four exclusive features shown above are typical of the big difference between Miehle-Dexter superchargers and other units. Features like these pay off in *bonus power*—up to *50% or more* when you put performance-proved Miehle-Dexter superchargers on Diesel or gasoline engines.

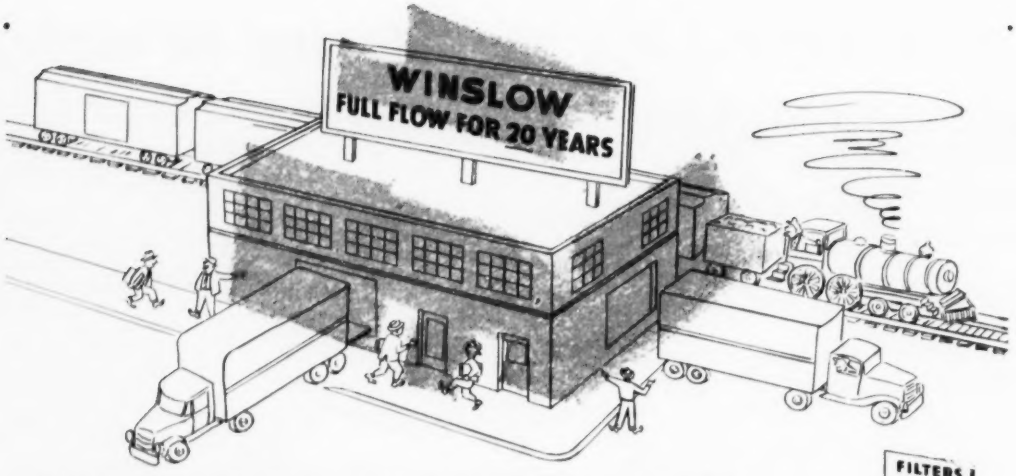
More, these features are the key to longer supercharger service life . . . efficient performance. There's a dividend in fuel economy, too.

Yes, if you want more usable horsepower without additional weight . . . without sacrificing valuable space, it's time to specify Miehle-Dexter superchargers. For more facts, call or write Miehle-Dexter.

MIEHLE-DEXTER SUPERCHARGER

DIVISION OF THE DEXTER FOLDER COMPANY

100 Fourth Street • Racine, Wisconsin



WHO PIONEERED FULL-FLOW FILTRATION?

WINSLOW,
OF COURSE

WHO SAID IT WOULDN'T WORK?

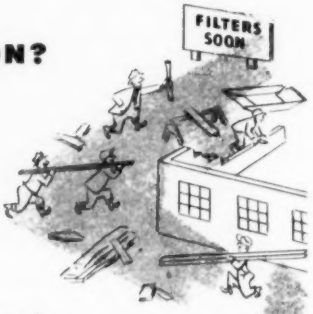
SEVERAL
COMPETITORS

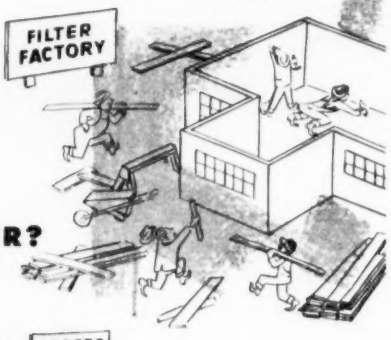
WHO IS NOW FALLING INTO LINE?

THOSE SAME
COMPETITORS

WHO IS STILL THE NATURAL LEADER?

WINSLOW, OF COURSE

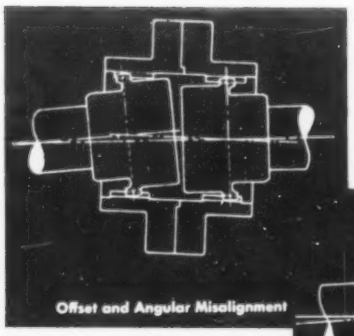


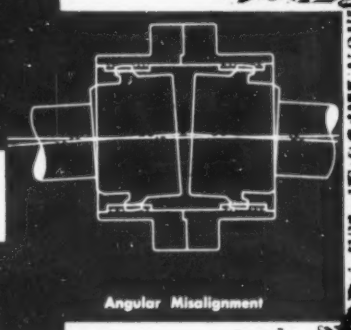


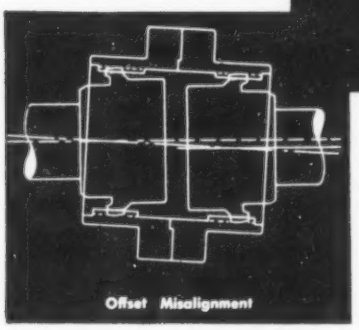
Write for our new **FREE BOOKLET** containing full information.

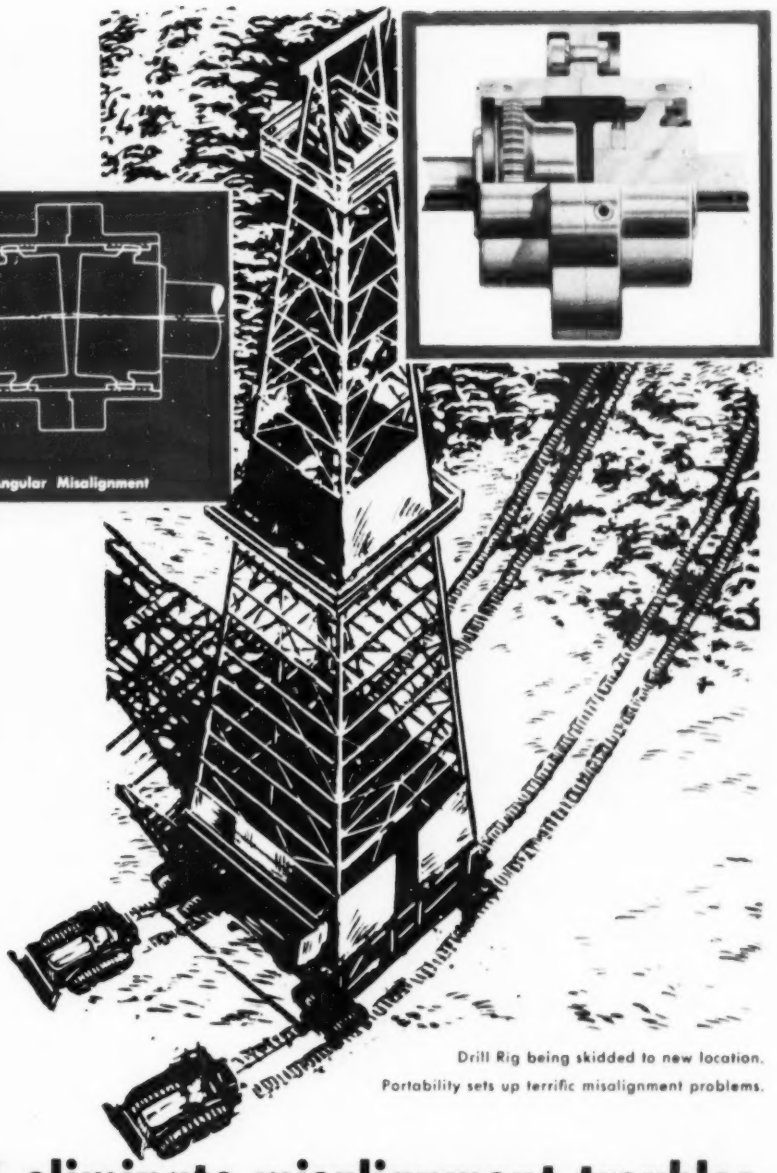
WINSLOW FILTERS

Winslow Engineering Company · **4069 Hollis Street** · **Oakland 8, California**









Drill Rig being skidded to new location.
Portability sets up terrific misalignment problems.

AJAX

DIHEDRAL COUPLINGS eliminate misalignment troubles on Stationary and Mobile Units

MEN who design, operate and service direct-driven generators, compressors, pumps, earth moving, oil drilling, crane and other equipment are turning to Ajax Dihedral Couplings for the answer to severe misalignment troubles.

Ajax Dihedral Couplings handle misalignment heretofore considered excessive. They have more misalignment capacity, less backlash and teeth are hardened to 50-55 Rockwell C.

Coupling cost is only a small fraction of shut down costs.

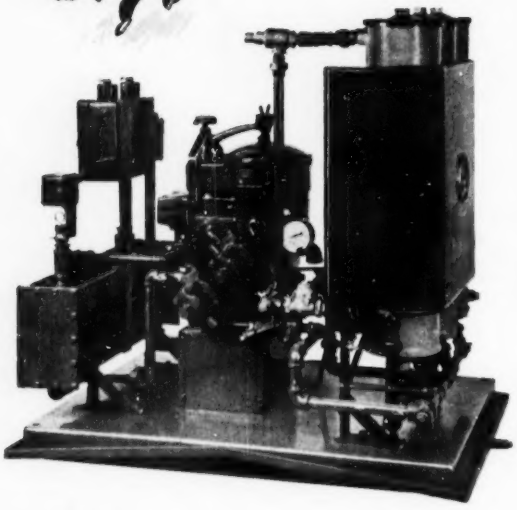
Write for complete information on this new, revolutionary and proven coupling.

AJAX KNOWS COUPLINGS

AJAX FLEXIBLE COUPLING CO. INC. WESTFIELD, N. Y.

A Great Double-Play Combination!

THE CENTRIFUGE AND THE FILTER



The De Laval "Puri-Filter" combines centrifugal purification and micronic filtration, producing the most effective means ever devised for maintaining the quality of diesel lubricating oil. The centrifuge is the De Laval "Uni-Matic"® Oil Purifier, which removes most of the solid impurities from the oil and all water that might be present. The filter is the Fram "Filcron" Filter that removes remaining colloidal carbon and restores the oil to a translucent amber color.

The "Puri-Filter" ***does not*** remove valuable additives in the oil. By effecting its valuable "double-play" cleansing of lubricating oil, it increases the useful life of the oil . . . and the life of the bearings as well. It minimizes ring sticking, and speeds up inspection, for crankcases are markedly cleaner when the oil is kept free of carbon, water and dirt.

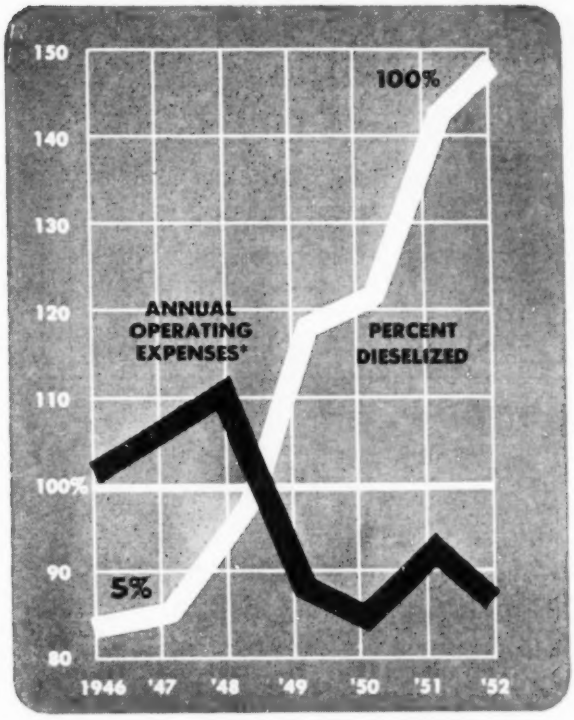
THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

● Send for Bulletin DL-1.

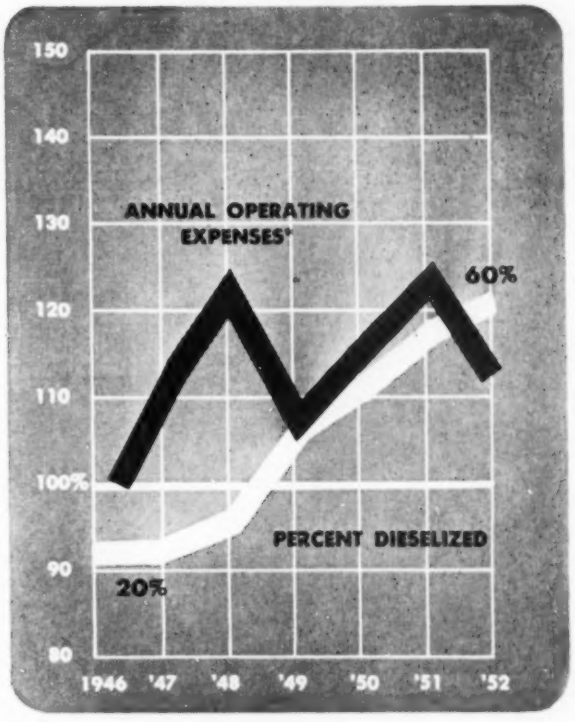
DE LAVAL *Oil Purifiers*

FOR DIESEL LUBRICATING OIL

THIS RAILROAD WAS COMPLETELY DIESELIZED IN 1952



THIS RAILROAD HAD REACHED ONLY 60% DIESELIZATION



*SOURCE: I.C.C. REPORTS. Annual operating expenses shown as a percentage of 1946 costs. Includes locomotive fuel, repairs, lubricants, water, supplies, enginehouse expense, enginemen's wages, fuel and water station maintenance.

Here's how Complete Dieselization pays off

In 1952 Diesel locomotives handled 65% of the freight, 72% of the passenger and 77% of the yard service on America's Class I railroads—at a saving of $604,063,000 *in fuel and maintenance costs alone.*

If all the remaining steam locomotives had been replaced with Diesels, an additional $249,168,000 could have been saved—an average of $17,780 for each serviceable steam locomotive whether in use or not!

EVERYBODY BENEFITS WITH COMPLETE DIESELIZATION

Write for booklet, "Safeguarding Railroad Earnings." It tells you why.

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

LA GRANGE, ILLINOIS · HOME OF THE DIESEL LOCOMOTIVE

GENERAL MOTORS LOCOMOTIVES

IN CANADA: GENERAL MOTORS DIESEL, LTD., LONDON, ONTARIO

P&H Diesel Engines

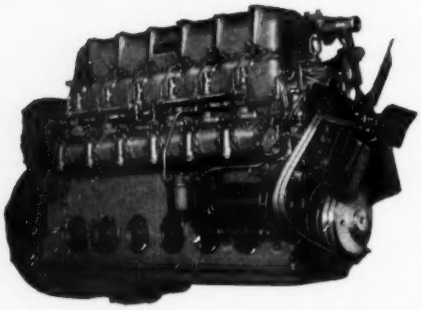
(2-CYCLE)

Can your diesels match this torque curve?

This is the torque curve for the P&H Model 687-C Diesel Engine. Note how the torque characteristics are sustained throughout its entire horsepower range.

That means steady, responsive power at all speeds — greater lugging "ability" for those toughest jobs. It's the kind of unfaltering performance that assures more profits in any service, constant or intermittent.

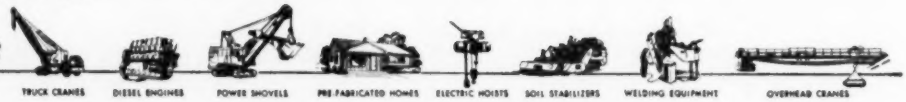
Steady torque for steady work is just another outstanding feature of P&H Diesel Engines — America's most advanced line. Ask your P&H Diesel representative for the full story. Or write for literature.



P&H Diesel Engines are built in 1, 2, 3, 4 and 6-cylinder models — up to 145 h.p.

P&H DIESEL DIVISION
HARNISCHFEGER CORPORATION
CRYSTAL LAKE, ILLINOIS

the P&H *Line*



Synchro-Start

OVERSPEED GOVERNORS

For Tachometer Drive Take-off

This Governor can easily be mounted at any location and driven by a standard S. A. E. Heavy Duty Flexible Shaft connected to the tachometer take-off.

It has a single pole double-throw switch enclosed in the cap for either Automatic re-set (Model GFA) or Manual re-set (Model GFM) with contact capacity of 10A at 125V non-inductive load. The rotating parts run in Sealed Ball Bearings lubricated for life and the entire unit is weather-proof.

These Governors can be mounted in any position and have the same characteristics as our Model GKA or GKM which we have been supplying for the past 20 years.

Speed can be adjusted to 20% over or under the ordered shut down speed while the engine is running. Ask for Bulletin 409-A or our catalog #4 describing our full line of Automatic engine control equipment.

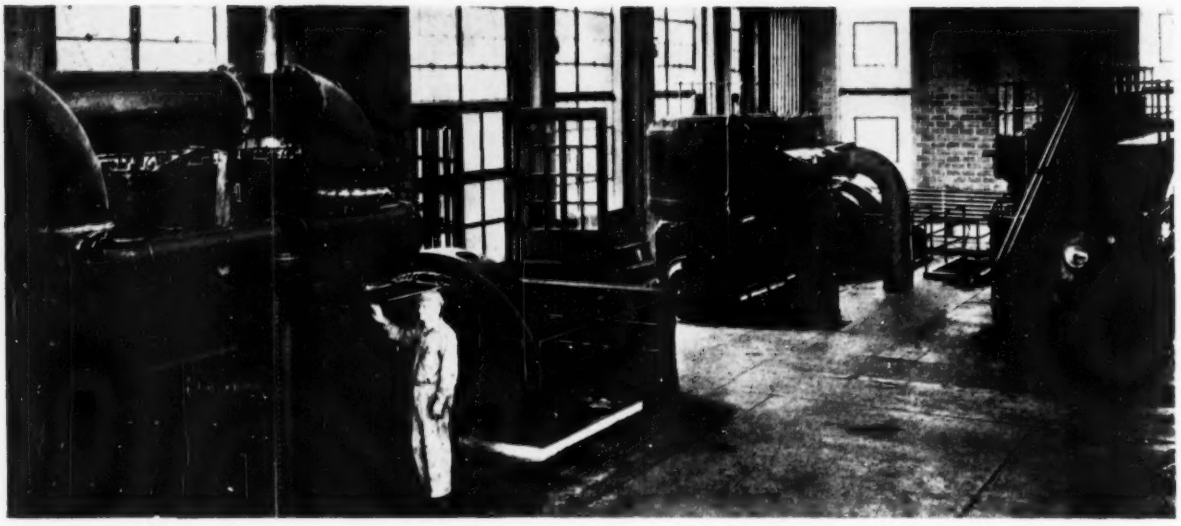
SYNCHRO-START PRODUCTS, INC.

Automatic Engine Control Equipment

8151 N. RIDGEWAY AVE. • SKOKIE, ILL.

H. L. Ostness, Chief Engineer, River Falls Municipal Utility, Wisconsin, says...

"Sticking Rings are no problem in this Plant"

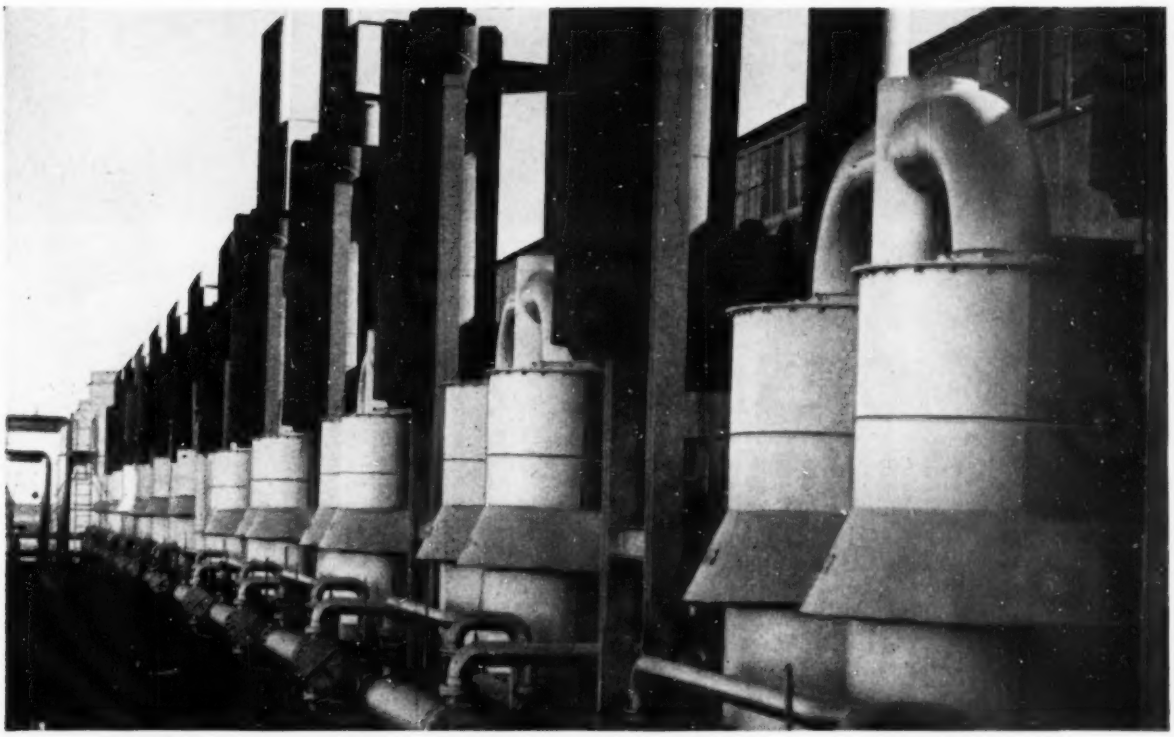


Mr. Ostness, as chief engineer of one of the oldest Municipal Power Plants in Wisconsin, knows diesels – *knows how to get the most out of them.* Mr. Ostness recently wrote, "We have used Sinclair Lubricants for over fifteen years very successfully. GASCON[00] and RUBILENE[00] H.D. have been doing an outstanding job in our diesels. Stuck rings is a trouble we know nothing about – engine wear is at an absolute minimum. With results like these, we'd recommend Sinclair Lubricants any time."

If your present lubricants do less, why not let Sinclair help you get longer life from your diesels – with less trouble. Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

save wear and replacement



Cycoil "lowers the boom" on DUST

Famous Oil Bath Air Cleaners Supply "Round the Clock" Protection For 17,750 Horsepower

Dust gets rough treatment at this Elk City, Okla. plant of Shell Petroleum. Standing guard at the air intake of each of 10 engines are two Cycoil Oil Bath Air Cleaners.

There's no compromise with perfection when Cycoil is on the job. It battles just as hard for the last particle of dust as the first. The plan of attack is simple, logical and highly effective. First, intake air is thoroughly mixed with oil which traps over 90% of the dust content. Second, final cleaning action is then taken over by dual filter pads which capture the remaining 10%, consisting mostly of those "hard to get" fine dust particles.

Yes, Cycoils deliver approximately 100% clean air. If you settle for less you merely delay the inevitable —costly engine down-time and repairs due to that 2% or 3% of dust that "got by".

Write for AAF Bulletin No. 130. It gives you the "inside" facts on Cycoil design—tells you why this Oil Bath Air Cleaner has become the accepted standard for complete dust protection.

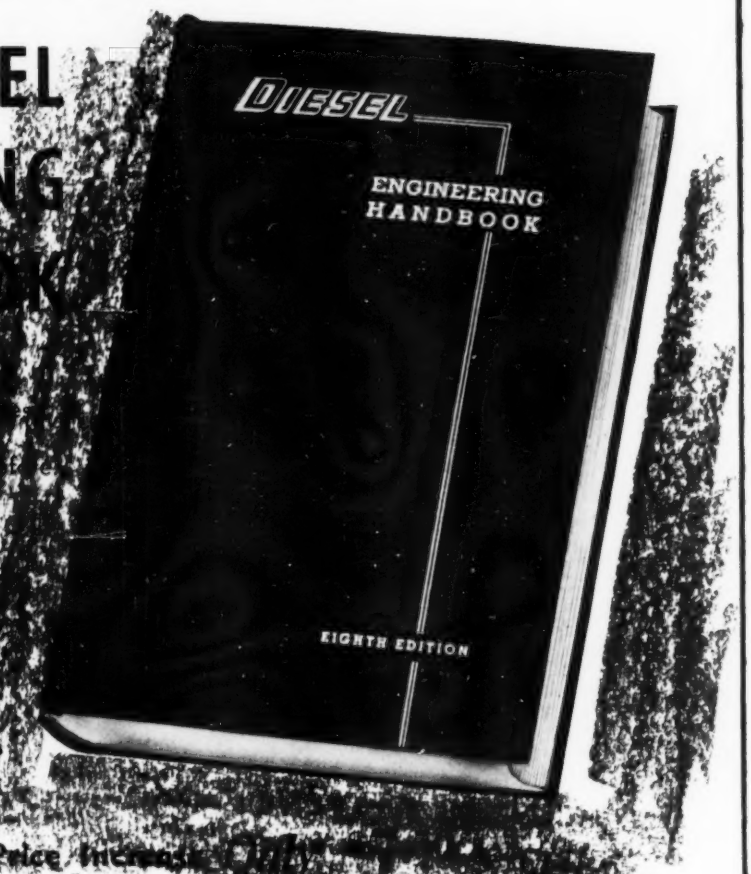
AAF **American Air Filter**

COMPANY INC.

445 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

New Comprehensive

DIESEL ENGINEERING HANDBOOK



Eighth Edition Completely R
18th Year—8th Edition—40
of previous editions in use
Now Bigger and Better Tha

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DIESEL Technology in its
Readable and Understand
Form on Stationary, Locomo
Automotive, Marine and Industr
Diesels and Dual Fuel Engines

Bigger . . . Better . . .

More Valuable

NO Price Increase

This book is as essential to all diesel men as the diesel engine is to power.

This book is the biggest help ever published for every diesel man from designer to operator—oldtimer to student beginner in diesel work.

Design, construction, installation, operation, maintenance and repair of diesels and every kind of equipment appear in this great volume.

Fuels and fuel systems—lubricants and lubrication—coolants and cooling, all fuel injection pumps and injectors—accessories and diesel equipment of all kinds are treated from the viewpoint of installation, use and maintenance.

Nothing is left to the imagination of the reader. The operator of one of the largest diesel schools in the U. S. A. once said, "With that DIESEL ENGINEERING HANDBOOK you run the biggest diesel school in the country". Now you get more text, more subjects, more illustrations, complete engine descriptions and full diesel specifications all for the same old price—Only $7.50. So new that the ink is "still wet"!

Order your copy today from the world's leading publisher of Diesel Magazines and Books.

DIESEL PUBLICATIONS, INC.
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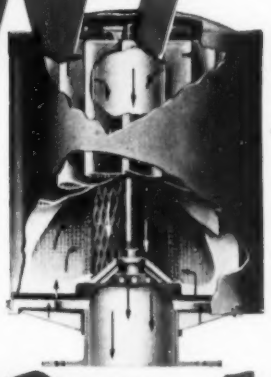
MOST EFFICIENT FILTER MONEY CAN BUY!



MODEL D
Intake Filter

STAYNEW INTAKE FILTERS

WHEN BUYING INTAKE FILTERS, you look first for efficiency. And, in Staynew Intake Filters, your dollars buy the MOST EFFICIENT INTAKE FILTER MADE!

They're *dry* . . . absolutely no oil carry over and no oil blow out on free air unloading equipment. They provide *maximum filtering area* in the smallest possible space. And they are *rugged!* Even under the most severe conditions Staynew Intake Filters perform a year or more *without attention.*

Get all the facts, and you'll buy Staynew Dry Type Intake Filters for the life of your engines.

The Staynew Principle is explained in Bulletin S.I.F. Write today!

DOLLINGER PROTECTO-MOTOR STAYNEW FILTERS

DOLLINGER

CORPORATION

10 Centre Park Rochester 3, N. Y.

Representatives in Principal Cities

ALL TYPES OF FILTERS
FOR EVERY INDUSTRIAL NEED

are engineered to make light work of tough jobs

Ask any one of thousands of power users! He'll tell you that Cummins Diesels are standouts wherever they work . . . that they lead the pack with more work done at lower cost, with superb performance in roughest going.

With a lightweight, high-speed (60-600 h.p.) Cummins Diesel, your fuel costs are lower than with any other engine in general use today. This is true because of the economy in fuel injection and metering provided by Cummins' exclusive fuel system . . . because of the inherent savings made possible by four cycle diesel design.

Maintenance costs are slashed, too. Extra care in engineering, manufacture and testing adds thousands of hours of trouble-free operation . . . keeps "down time" at a minimum. Contact your Cummins dealer. He's a diesel power specialist—ready to show you how to apply Cummins savings to your jobs.

CUMMINS ENGINE COMPANY, INC., Columbus, Indiana

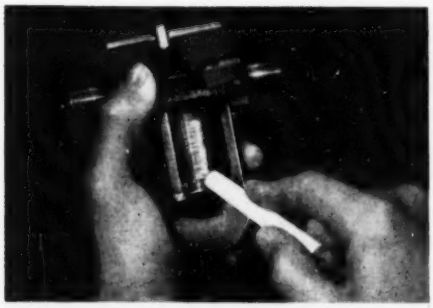
Export: Cummins Diesel Export Corporation, Columbus, Indiana, U.S.A. • Cable: CUMDIEX

CUMMINS

Leaders in rugged, lightweight, high-speed diesel power!

Here's how this strainer "combs" itself clean!

This simple chalk test shows how AUTO-KLEAN's unique built-in comb construction cleans the strainer without costly interruption of flow



ORDINARY BLACKBOARD CHALK leaves heavy deposit of chalk particles on and between discs of Cuno AUTO-KLEAN strainer.

TURNING HANDLE ONE REVOLUTION moves strainer element through comb blades, removing all traces of chalk from between discs. Cuno's exclusive combing operation cleans *thoroughly* —without stopping flow.

FILTERING AREA IS COMPLETELY CLEAN, restoring full initial capacity. All chalk particles and dirt fall to bottom of housing where they can be drained periodically.

- AUTO-KLEAN's permanent metal filter element is available in steel, brass, or stainless steel for long, trouble-free service.
- AUTO-KLEAN is adaptable to any fluid-flow system.
- From acids to tar . . . if you can pump it, Cuno can filter it. Capacities range from one gallon per hour to 15,000 gallons per minute.

CUNO **ENGINEERED FILTRATION**

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

SINGLE-STRAINER FLUID PROTECTION FOR DIESEL ENGINES

Continuously cleanable AUTO-KLEAN eliminates need for stand-by strainers

Sludge and other contaminants are easily gotten rid of when *all* the lubricating oil is sent through Cuno AUTO-KLEAN strainers. AUTO-KLEAN's compact construction provides this *full-flow* fluid protection in space which would limit ordinary filters to by-pass service.

The low pressure drop of AUTO-KLEAN strainers permits full-flow service on gravity, low pressure, or suction lines, with no loss in operating efficiency.

Cuno's exclusive "comb-clean" action provides *complete* cleaning of the filter element—without stopping fluid flow. Thus there's no need for a stand-by strainer.

The low maintenance costs of the AUTO-KLEAN save you money, for there are no cartridges to change. An occasional rotation of the handle does the cleaning job (most units can be equipped with motor drives for continuous cleaning).

Fixed-space metal discs in this modern strainer positively remove all solids larger than the specified disc spacing—from .0035" up to .062".

For permanent, positive Diesel protection, install compact Cuno AUTO-KLEAN—the precision-built strainer. Send the coupon for free bulletin.

A 3.1

Cuno Engineering Corporation
Dept. 251A, South Vine Street, Meriden, Conn.

Please send me bulletin on Cuno AUTO-KLEAN for Diesel engine protection.

Name.....

Company.....

Address.....

City.....Zone....State.....

...with TYCOL lubricants on hand!

It pays to buy a "Diesel-Designed" Lubricant! ... It takes "something more than a motor oil" to counteract excessive wear in Diesel engines – and we proved it with Tycol Adeltran 40! In this instance, a Diesel engine was operated for one year with a competitive oil. An overhaul by the manufacturer turned up these conditions: all liners had to be replaced as well as piston rings ... 2 top compression rings were stuck and all rings were gummed up. After the switch to Adeltran (for the same operating period) liner wear was negligible ... filter life was considerably extended ... all rings were free and in excellent condition ... and owner reported an exceptionally clean engine base. For full details on Adeltran, contact your local Tide Water Associated office!

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C. • Pittsburgh
Philadelphia • Chicago • Detroit
Tulsa • Cleveland • San Francisco
Toronto, Canada

Over 300 Tycol industrial lubricants are at your disposal ... engineered to fit the job!

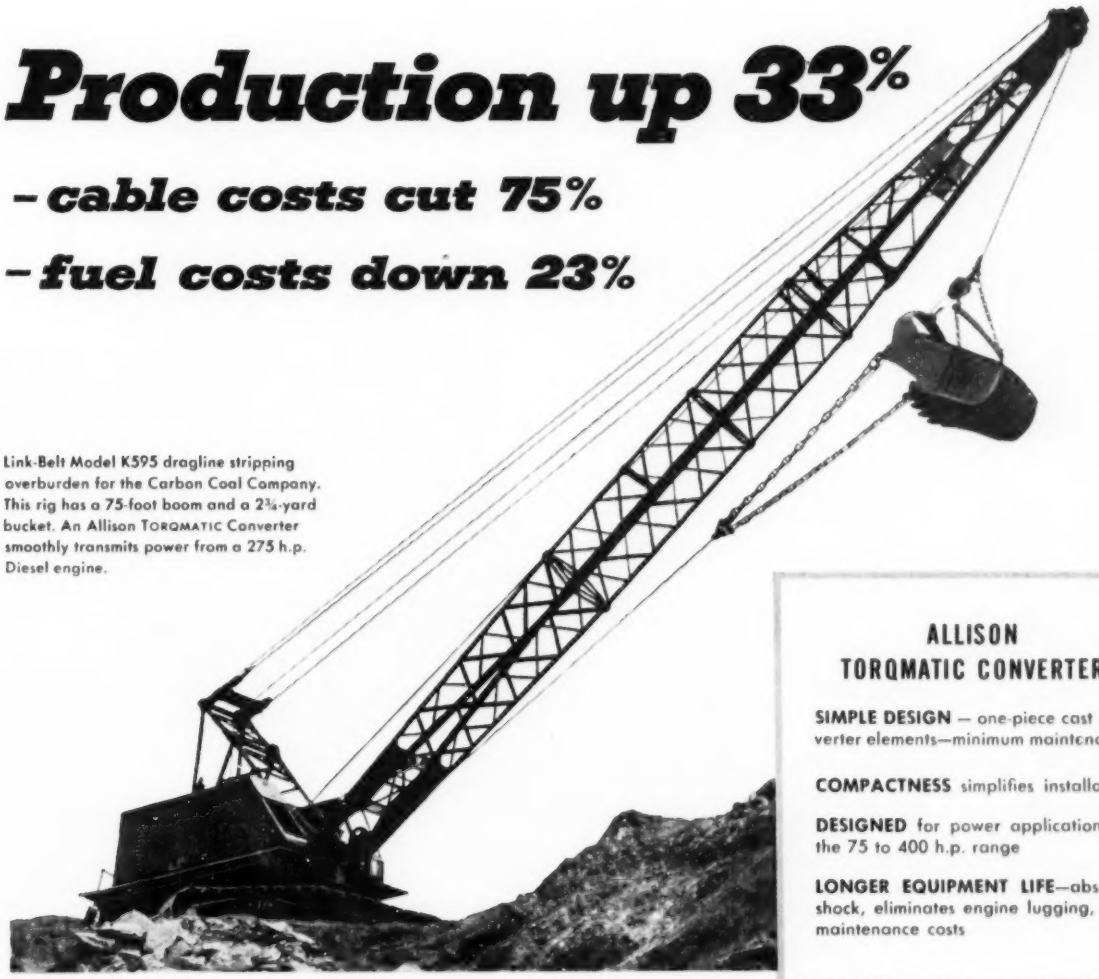
TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE - NEW YORK 4, N.Y.

REFINERS AND MARKETERS OF VEEDOL ... THE WORLD'S MOST FAMOUS MOTOR OIL

Production up 33%

–cable costs cut 75%

–fuel costs down 23%



Link-Belt Model K595 dragline stripping overburden for the Carbon Coal Company. This rig has a 75-foot boom and a 2¾-yard bucket. An Allison TORQMATIC Converter smoothly transmits power from a 275 h.p. Diesel engine.

ALLISON TORQMATIC CONVERTER

SIMPLE DESIGN — one-piece cast converter elements—minimum maintenance

COMPACTNESS simplifies installation

DESIGNED for power applications in the 75 to 400 h.p. range

LONGER EQUIPMENT LIFE—absorbs shock, eliminates engine lugging, cuts maintenance costs

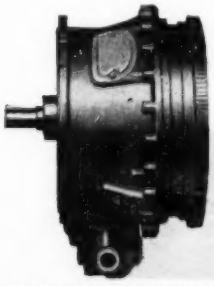
Here's another operator who's boosting production and cutting costs with Allison TORQMATIC DRIVES: The Carbon Coal Company operates two Link-Belt draglines, strip-mining coal near Grove City, Pa. The units are nearly identical—one has an Allison TORQMATIC Converter, the other is direct-driven—but there's a big difference in operating costs and production.

The Allison Converter absorbs shock loads so dragline cable on the TORQMATIC-equipped unit lasts four times as long, *saving $2160 a year on cable alone*, a reduction of 75%.

The TORQMATIC-equipped unit strips a 60x40x25 foot "lift" of overburden in 24 hours against 32 hours for the direct-driven unit, a 33% increase in production. A comparison of daily fuel records shows the friction drive unit consumes 130 gallons while the Converter-equipped unit uses only 100 gallons, a cut in fuel costs of 23%.

The TORQMATIC-equipped unit has rolled up such an impressive performance record that this operator intends to specify TORQMATIC DRIVES in all his new heavy-duty equipment. You, too, can cut your costs by specifying Allison TORQMATIC DRIVES the next time you buy. Ask your equipment dealer, manufacturer or write:

ALLISON DIVISION OF GENERAL MOTORS
Box 894SS, Indianapolis 6, Indiana



Allison **TORQMATIC DRIVES**

GM GENERAL MOTORS

COMPACT, EFFICIENT HYDRAULIC DRIVES FOR CRANES • TRUCKS • TRACTORS • SCRAPERS • SHOVELS • DRILLING RIGS

94.9% of Lockheed's 50,000 employees are enrolled in the Payroll Savings Plan

ROBERT E. GROSS

President, Lockheed Aircraft Corporation

National Chairman, 1953 Aircraft Industry Payroll Savings Drive

"A man's personal economic security is the sum of his own diligent effort, a financially sound government and a systematic savings plan. He has the earnings and he has the government that can protect the individual. However, human nature being what it is, not everyone maintains a systematic plan of savings. So here is a plan designed to help the employee—the Payroll Savings Plan, whereby his company will regularly invest a part of his earnings (he specifies the amount) in United States Savings Bonds, America's safest form of investment. We at Lockheed have endorsed and encouraged this plan because we know what it does to assure security—both individual and national."

Lockheed Aircraft Corporation recently conducted a person-to-person canvass that put a Payroll Savings Application Blank in the hands of every employee of Lockheed's eleven plants in Southern California. At the conclusion of this one-week campaign, 36,419 of the 38,037 employees—95.7%—had signed up on the Payroll Savings Plan. Three of the eleven plants achieved 100% enrollment.

Lockheed's 95.7% in the Southern California plants is the highest employee participation of any company or group of this size this year. The previous national record in the aviation industry—92%—was set by Lockheed's Georgia Division in April, 1953. Of Lockheed's total payroll—50,000 men and women—94.9% are building ". . . security—both individual and national" by systematic investment in U.S. Savings Bonds.

45,000 companies operate Payroll Savings Plans. In many of these companies employee participation ranges from 60% to 80%; in some, it is even higher. On the basis of Payroll Savings Records, it is safe to estimate that 60% or more of the personnel of a company will join the Payroll Savings Plan—

—if the many personal benefits of the Payroll Savings Plan are properly presented to them by management.

—if they are shown how their monthly investment in Savings Bonds contributes to national stability by adding to our reservoir of future purchasing power—$35.5 billion—the cash value of outstanding Series E Bonds—the kind purchased by Payroll Savers.

Your State Director, U.S. Treasury Department, is ready to help you build a 60%, 70% or 80% Payroll Savings Plan. He'll explain how easy it is to conduct a simple person-to-person canvass and will furnish all the printed matter, posters, etc. Phone, wire or write today to Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Building, Washington, D.C.

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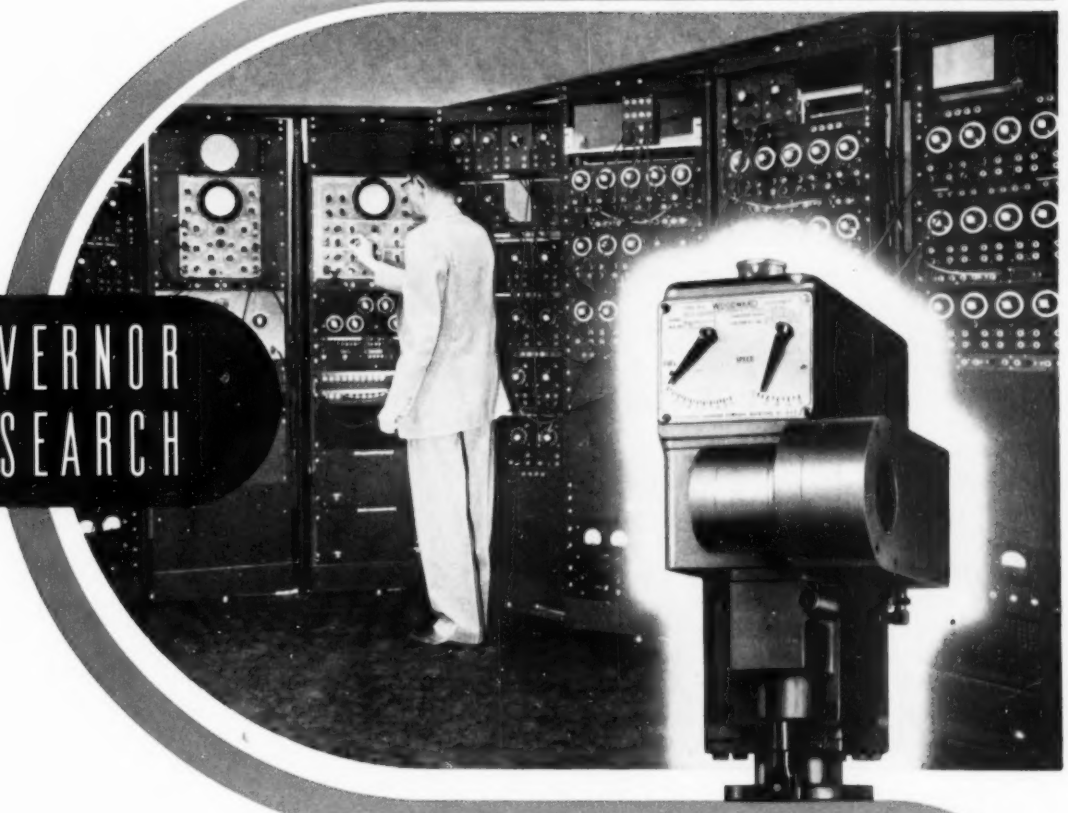
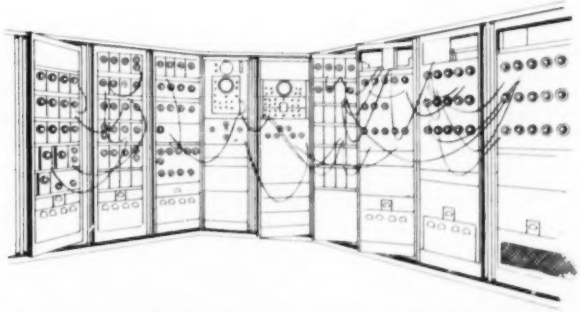
DIESEL POWER AND DIESEL TRANSPORTATION

GOVERNOR RESEARCH



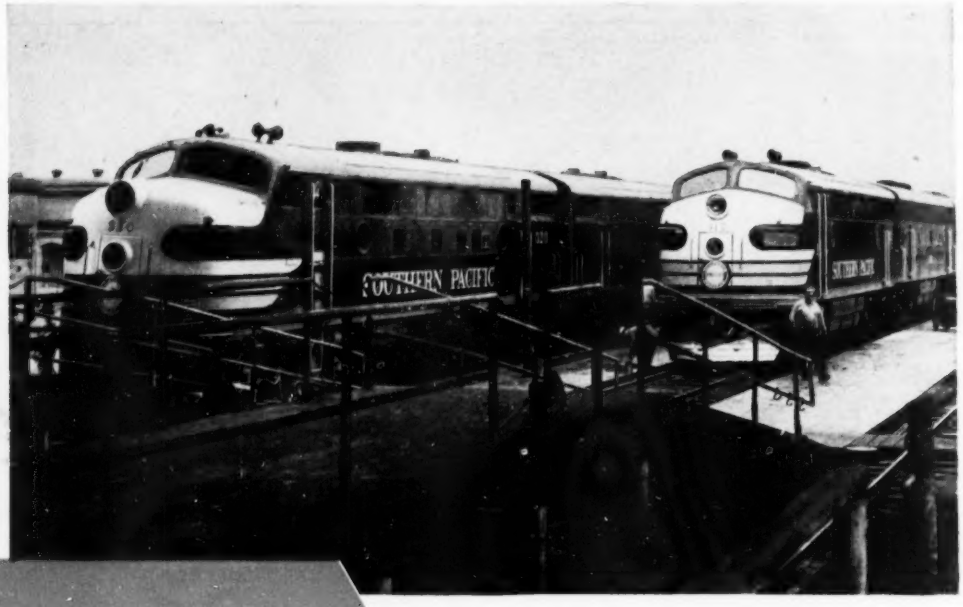
Our analogue computer is a mathematical tool used by our research staff to determine the best governor design for a particular application. The instrument itself is an electrical assembly incorporating numerous vacuum tube circuit components. The mathematical solutions appear as line images on the faces of oscilloscope tubes.



WOODWARD GOVERNOR COMPANY
ROCKFORD, ILLINOIS

World's oldest and largest manufacturer of hydraulic governors for prime movers.

The oil with *3-way action* that keeps railway Diesels clean



1. **Fights piston ring belt deposits (effective detergent action).**
2. **Resists sludging (high stability).**
3. **Prevents hard deposits on piston crowns (base stock quality and refining methods).**

GULF DIESELMOTIVE OIL

These are the reasons why Gulf Dieselmotive Oil protects against the accumulation of harmful deposits on compression and oil-control rings, on piston crowns, and in ports. Because engines lubricated with Gulf Dieselmotive Oil stay cleaner, they use less oil and require ring jobs less often. This means lower maintenance costs and less time off the road. For further information, write, wire, or phone your nearest Gulf office.

GULF OIL CORPORATION
GULF REFINING COMPANY
PITTSBURGH 30, PENNSYLVANIA

GULF

Editorially Speaking . . . .

Likes and Dislikes (Engines, that is)

PANDORA'S box had nothing on the editorial mail basket. It gives out with everything from fulsome praise (hah!) to woeful brickbats (sob!). But most important, it is a reservoir of ideas without which things would be pretty dull around here.

On our monthly fishing expedition to get an idea for this particular monthly stint we dredged up a choice specimen. It came in a letter from one of our highly valued contributors in which he discusses his use of a certain weight oil in his engines. He winds up saying, "If you are a thick oil man you will say, 'Too thin'. But it works and the proof of the pudding is in the eating."

We have a trigger mind (some harsh critics contend that we should give it back to Trigger) and this is all that is needed to set us off, for better or for worse.

One of the things that we have learned in the course of long association with engines is that it is entirely unimportant whether we like something; the important thing is whether or not the engine likes it. One engine's oil is another engine's damaged bearings!

What a picnic it would be for the oil people if all that they had to worry about was what the customer liked! They could make amber oil, green oil, both light and heavy, and forget the whole thing. And a lot of competent oil engineers would hit the relief rolls. But the fact that a lot of these fellows are beating their heads against lubrication problems every day of the week including Saturdays and Sundays is proof that the matter goes beyond personal preferences.

The engine is the tyrant and you give it what it wants—or else. This "or else" is generally a bill payable in down time or in those greenbacks that you had stashed away after Washington got through with you. To paraphrase an old Army saying, "the engine can't make you do anything, but it can sure make you wish that you had".

It is not only a matter of lube oils, the principle applies to just about everything in the engine. For example, the engine knows what piston rings it likes to run with a certain liner in such-and-such a condition, with certain lube oil, and a particular cooling-water temperature. The trick is to learn what the engine likes and indulge it. Then you can turn around and work the devil out of it —and it will love it!

This puts a premium on good operators, for it is only they that get the chance to "live" with the engine and learn its idiosynerasies. The starting point is the manufacturer's recommendations, but these of necessity must be broad in scope. Variations in the condition of servitude of engines and the diet available locally may call for modified treatment. Then, careful planning based on what the engine tells you is the answer. Good records, carefully analyzed, will help you interpret the engine "talk".

No, we are not a "thin oil" or a "thick oil" man; we are a "what-does-the-engine-like" man. How about you?

D.R.E.

SPECIALIZED POWER from FAIRCHILD

JET POWER for a guided missile . . . take-off boost for a commercial or military transport . . . main power source for a piloted plane . . . these are potential uses for the Fairchild turbojet engines.

The J-44, now in production, was the first choice for the new high-speed, high-altitude Ryan Firebee target drone. This engine design, proving its worth *today*, has unlimited possibilities for *tomorrow*.

* * *

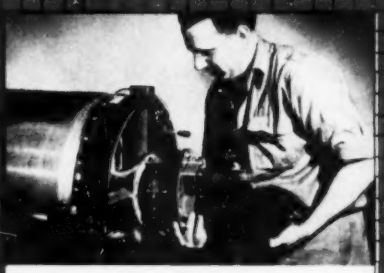
FAIRCHILD'S monocoque construction is another important development by an organization with over 25 years of power plant experience. Working for all three branches of the services, this development and production team is looking ahead to meet the challenge of *specialized power* on land, in the sea, and in the air.

J-44 SPECIFICATIONS

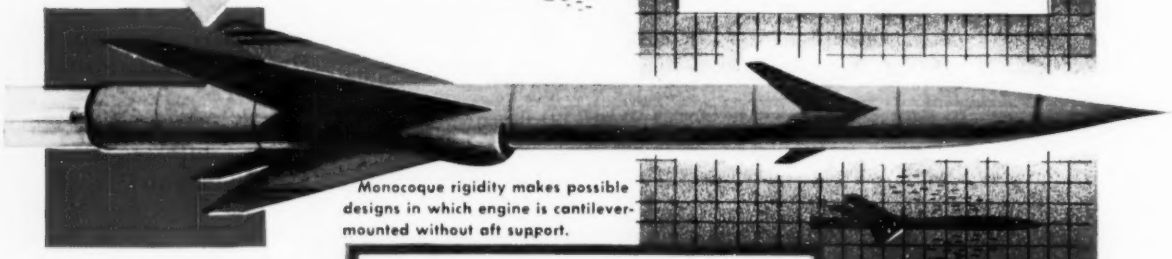
Announced thrust	*1000 lbs*
Weight	*300 lbs*
Length	*72 inches*
Diameter	*22 inches*

PRODUCTION, with unique monocoque construction, minimizes heavy castings and machined parts, speeds up manufacturing.

OVERHAUL and service is simplified — shown are only tools required for complete assembly or dissembly.



INSTALLATION is simplified with removable accessory section, containing essential controls, fuel pump and electrical units.



Monocoque rigidity makes possible designs in which engine is cantilever-mounted without aft support.

ENGINE AND AIRPLANE CORPORATION

FAIRCHILD

Engine Division

Farmingdale, L.I., N.Y.

Aircraft Division, Hagerstown, Md.
Guided Missiles Division, Wyandanch, L.I., N.Y.

+ HIGHLIGHTS +

● SAE's International West Coast Meeting will be held in the Georgia Hotel at Vancouver, B. C. from Aug. 17 to 19, 1953.

● The Tractor and Production Forum sponsored by the SAE is scheduled for the Hotel Schroeder in Milwaukee, Wisconsin. The date—Setember 14 to 17, 1953.

● Bucyrus-Erie and International Harvester recently announced that Bucyrus-Erie Equipment will be sold by I-H dealers. Eventually, B-E equipment will be manufactured by I-H.

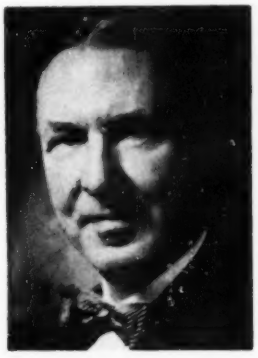
● The annual meeting of the American Society of Civil Engineers will be held at the Hotel Statler in New York City from October 19 to 23, 1953.

● State Fair Grounds in St. Paul will be the scene of the National Truck Roadeo from September 22 to 26, 1953. The U. S. Air Force will join with the ATA this year to hold its own National Motor Vehicle Roadeo concurrent with the Truck Roadeo.

● On the B & O Budd diesel rail cars are being used for commuter service in the Pittsburgh area. Cruising speed for these efficient diesel-powered units is 70 mph. Top speed is 83 mph.

● September 21 to 25, 1953 is the date for the Eighth National Instrument Conference and Exhibit sponsored by the Instrument Society of America. The place—The Hotel Sherman, Chicago, Illinois.

● Average figures for annual kwh consumption by residential customers for 1941 and 1951 listing cities of 50,000 population and more is available from the Publications Division, Federal Power Commission, Washington 25, D. C. at 50 cents per copy. The order number is FPC-46.



Wilbur W. Young

Diesel Power takes pleasure in announcing the appointment of Wilbur W. Young as Assistant Publisher. Mr. Young has been associated with the diesel industry for nearly 15 years, first as Managing Editor and later as Vice President of Diesel Progress from which he recently resigned. He received his education in mechanical engineering at Penn State, class of 1920 and prior to entering the diesel publishing business, held executive positions in sales engineering and in the automotive field with General Motors Corporation and the Ford Motor Company.

Mr. Young is a member of both the ASME and SAE and has served on the Executive Committee of the ASME Oil and Gas Power Division for nearly 10 years.

The appointment of Mr. Young to the Diesel Power Staff, is in line with the policy of steady growth and expansion carried out since the present publisher took over some two years ago. Mr. Young brings to this program his wealth of experience and wide-spread acquaintance in the diesel industry in particular and will generally assist the publisher in carrying out extensive plans for constantly improving service to readers and advertisers alike.

● Boston will be host to the Industrial Packaging and Material Handling Exhibit from October 20 to 22, 1953.

● The 50th anniversary of the American trucking industry will be commemorated by a stamp which was recently aproved by the Postmaster General.

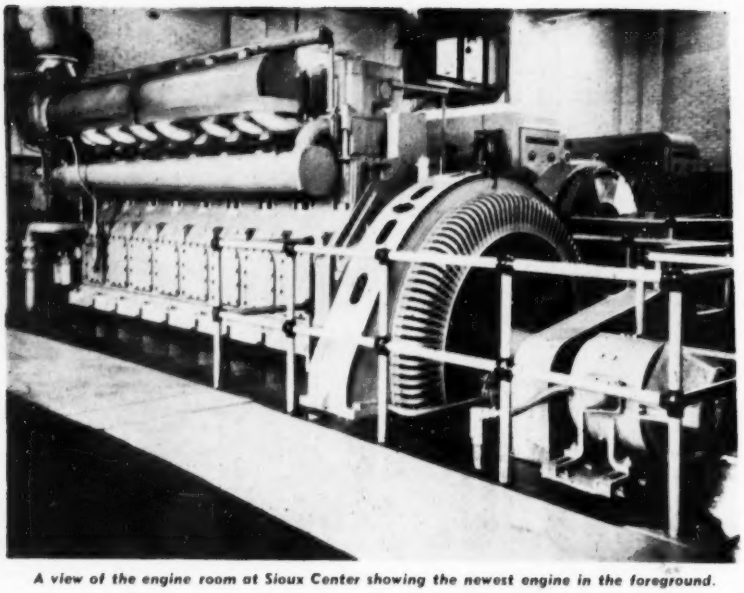
● In 1937 no trucks were used in open pit mining operations. Today, in the Mesabi Range alone, more than 1000 heavy-duty, specially-constructed trucks are used. Diesel-powered, of course.

● Hope National Gas Company of Clarksburg, West Virginia has received authorization from the FPC for development of an underground gas storage pool in Lewis and Harrison Counties, W. Va.

● Diesel service on the Canadian National Railways is steadily being extended according to Mr. S. F. Dingle, Vice president in Charge of Operations for the CNR. This is part of a 5-yr dieselization program currently being conducted by this road.

● According to the National Safety Council occupational accidents in 1952 cost American industry approximately $45 per worker. The 1953 issue of "Accident Facts" is just off the press and available through the National Safety Council, 425 North Michigan Ave., Chicago, Ill., at 75 cents per copy.

● Budd recently announced the sale of three more self-propelled diesel rail cars. Two have been delivered to the Rock Island Railroad and the other will begin service on the Boston and Maine, early this fall. This is the first order for RDC units from the Rock Island. The B & M will have seven RDCs in operation when this latest unit is placed in service.



A view of the engine room at Sioux Center showing the newest engine in the foreground.

Sioux Center, Iowa

SIOUX Center, with a population of 1360, is located approximately 45 miles north of Sioux City, Iowa. It is a trading center for a prosperous farming and dairying territory. The largest local industry is the Farmers Mutual Cooperative Creamery which occupies an entire block adjoining the power plant.

When Sioux Center started up its municipal generating station in the fall of 1949 following the acquisition of a local distribution system, it quickly discovered that the initial installation of 720 kw in diesel generating equipment was not going to be sufficient to dependably meet present and future demands.

After extensive planning, the city installed another generating unit in 1950 which more than doubled plant capacity. This engine was a 4-cycle, 8-cyl turbocharged Nordberg rated 1060 hp at 400 rpm. Bore and stroke for this engine are 13 in by 16½ in respectively.

Direct connected to the unit is an Electric Machinery 745-kw, 3-phase, 60-cycle, 2400-v generator. A 15-kw, 125-v shunt-wound exciter operating at 1150 rpm is vee-belt driven from the generator shaft. Voltage regulation is maintained by an individual regulator for the unit. Individual fuel metering pumps are located adjacent to each cylinder, permitting the use of fuel lines of equal length between each fuel pump and injector. A common camshaft gear-driven from the flywheel end of the engine carries all fuel pump, intake valves and exhaust cams.

Engine cooling is provided by two fan-cooled radiators located in an extension to the southwest corner of the plant building. Louvers on the south, west and north walls of the structure can be adjusted to draw air through either cooler or through the two in series. Doors between the engine and cooler rooms can be opened or closed to either draw hot air out of the engine room during summer months or deliver hot air to the engine room during winter months for building heating. Variable-speed motors control radiator fan speed.

A thermostatically-controlled by-pass valve in the engine jacket water circuit maintains water to the engine at a constant temperature. Cooling water for the turbocharger is provided by a by-pass line connected between the jacket water inlet and outlet.

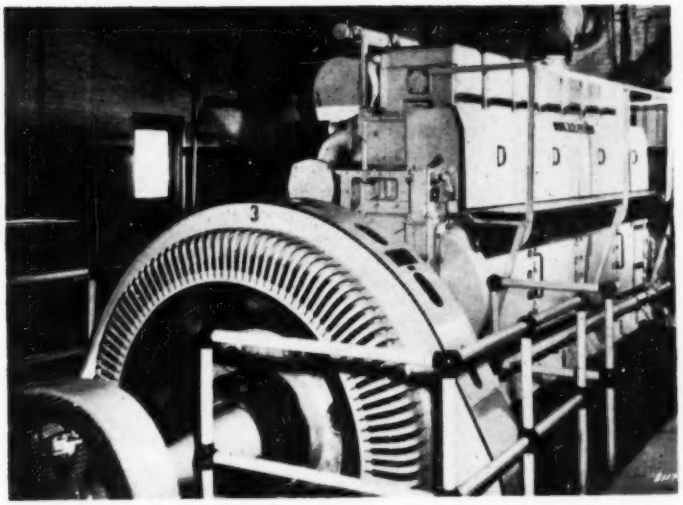
Lubricating oil is cooled in a shell-and-tube type heat exchanger installed in the inlet side of the cooling water circuit. The lube oil pressure system is made up of a positive-displacement rotary-type pump driven from the engine crankshaft, the oil cooler, filter, and manifold header on the engine. Drilled passages in the connecting rods and crankshaft provide piston pin lubrication and a sprayer for piston cooling.

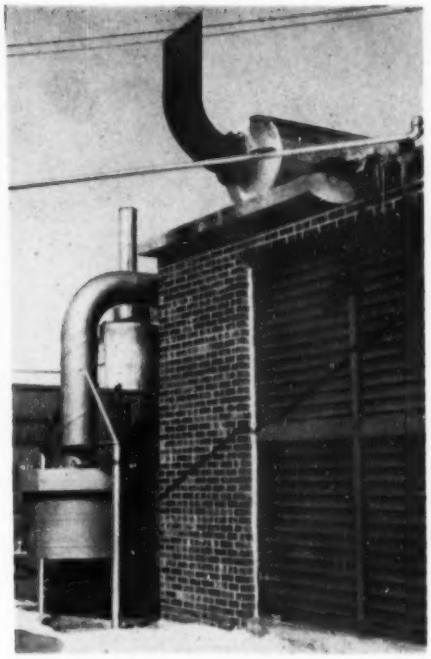
Intake air passes through an oil bath type filter and a snubber. The air filter is of Air Maze design, while the snubber is a Burgess-Manning unit. A Burgess-Manning muffler is installed in the exhaust line. Corrugated expansion joints are installed in both the air intake and exhaust lines.

Performance Figures

During the past two years, the Nordberg unit produced better than 14 kwh per gal of fuel. In 1951, the engine operated 7439 hr at an average load of 277 kw to generate 2,062,300 kwh. It produced 14.3 kwh of electrical energy for every gal of fuel oil consumed.

In 1952, during 5015 hours of operation, the average load was 436 kw and 14.4 kwh was generated per gal of fuel burned. These fuel figures show the relatively con-





Above, is the operating side of the Nordberg turbocharged unit rated 1060 hp. At right, louvere panel for cooling tower circulating air can be seen. These louvers are varied in adjustment depending on the method of circulation desired. Air can be circulated through either, or both cooling towers in series.

stant energy production per gal of fuel over a wide load range, a characteristic of supercharged 4-cycle design.

During the 12,454 hours of operation in this two year period, 693 gal of lube oil was consumed. This averages out to approximately 19,100 rated hp-hr per gal of lube oil.

A summary of operating data for the Nordberg unit and plant production costs for 1952 is shown in the accompanying tables. The average production cost for the entire plant per kwh for 1952 was 12.46 mills of which 7.86 mills represents fuel, 3.73 mills represents labor, and the balance of 0.87 mills is for all other costs including maintenance.

Responsible for the operation of this plant is A. M. Verrips, plant superintendent. Mr. Verrips, a Navy man in World War II, has carried over into the operation of this plant that Navy habit of keeping everything spic and span. This constant housecleaning activity is paying off in the operation of the Sioux Center municipal power plant. It is paying off through the continued high availability of generating units, good fuel and lubrication performance, and low maintenance costs.

Engine Operating Data

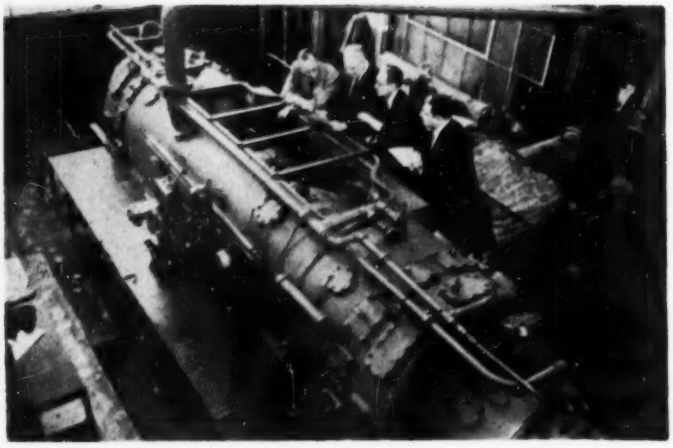
Year	1951	1952
Plant gross generation, kwh	2,937,600	3,068,600
Generated by Nordberg Unit, kwh	2,062,300	2,187,100
Per cent plant gross generation supplied by Nordberg Unit	70.3	71.3
Hours operated	7,439	5,015
Average load, kw	277	436
Fuel-oil consumption, gal	144,007	151,564
Kwh per gal fuel oil	14.3	14.4

Station Production Costs, 1952

		Total	Mills/kwh
Operation:	Salaries and wages	$11,433.89	
	Fuel	24,125.99	
	Lubrication	434.74	
	Insurance	682.48	
	Supplies	553.15	
	Miscellaneous	84.88	
		$37,314.73	12.16
Maintenance:	Material	833.13	
	Salaries and wages	73.82	
		906.95	0.30
Total production cost		$38,221.68	12.46

Principal Equipment

Engine	Nordberg Mfg. Co.
Generator	Electric Machinery Co.
Exciter	Electric Machinery Co.
Turbocharger	Elliott Co.
Governor	Woodward Governor Co.
Jacket water coolers	Young Radiator Co.
Jacket water pump	Worthington Corp.
Exhaust snubber	Burgess-Manning Co.
Multiflex expansion joint	U. S. Rubber Co.
Intake air silencer	Burgess-Manning Co.
Intake air filter	Air-Maze Corp.
Temperature regulator	Fulton Sylphon Co.
Lube oil cooler	Ross Heater & Mfg. Co.
Fuel oil meter	Pittsburgh Equitable Meter Co.
Lube oil purifier	U.S. Hoffman Co.
Exhaust flexible connector	Chicago Metal Hose Co.
Pyrometer	Illinois Testing Laboratories



Cooper-Bessemer's free-piston engine on the test floor. Discussing the unit are, left to right, Mr. R. L. Boyer, chief engineer; Mr. R. P. Ramsey, project engineer; and Messrs. D. A. Klinger and W. A. Moraine of the Engineering Experimental Department. This is only picture pertaining to this unit.

Cooper-Bessemer's Free Piston Engine

Applying the principle of burning fuel at high compression pressures—the principle that yields such high efficiencies in diesel engines—Cooper-Bessemer has a newly-developed free-piston engine that provides a source of hot gases for turning a gas turbine.

Under wraps for several years, development work on the free-piston engine is rapidly approaching what the designers believe to be a practical solution to a heavy-duty gas turbine-type prime mover. It gives evidence of offering the unmatched efficiency found only in the finest diesels today.

Research and development work has been under the direction of Ralph L. Boyer, vice president and chief engineer, and Robert P. Ramsey, consulting engineer. Following are their answers to some questions concerning this development.

WHAT is a free-piston engine?

Basically, the free-piston engine is a simple, opposed-piston internal combustion engine without a crankshaft or connecting rods. The work of many pistons in the ordinary internal combustion engine is handled by just two pistons which directly oppose each other in a single cylinder.

How does it work?

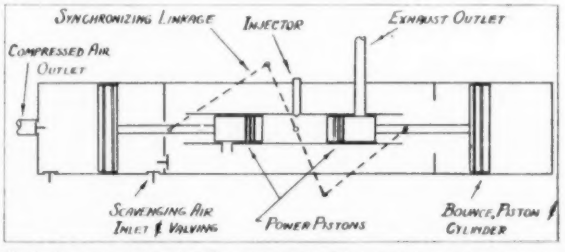
Fuel is ignited in the space between the two power pistons. The burning gases force them apart to actuate compressor pistons directly attached to them. As the piston assemblies reciprocate, air pumped by the compressor pistons is directed through the combustion cylinder. This air cleans out the hot gases of combustion in the cylinder and drives them through a pipe to propel the blades of the turbine rotor.

When cylinder pressures have dropped, pneumatic pressure forces the pistons to come together on the compression stroke. Remaining air in the cylinder is compressed, fuel introduced, ignition occurs, and another power stroke is started. The cycle is repetitious and the pistons continue to reciprocate smoothly.

What are some of its advantages?

First, being relatively small, simple, and compact, the free-piston engine and turbine requires less space than needed by other prime movers. It can generally be installed at a much lower cost per hp and is expected to require less expense to maintain and supervise. Practically free of vibration, the free-piston engine needs but a fraction of the foundation size of conventional prime movers. Its basic requirement is as much as 30 to 60 per cent less than for other types.

High operating efficiency, which means low fuel consumption, is one of the free-piston engine's greatest advantages over the conventional gas turbine. Efficiencies as high as 40 per cent are possible with this unit compared to commercial attainment of efficiencies in the 25 per cent range in conventional gas turbines of today.



Illustrating principles of a European-designed free-piston engine-air compressor. Piston synchronization, necessary in all cases, is accomplished by linkage. On power stroke, compressor piston, left, delivers pressurized air and intakes scavenging air (later compressed on return stroke). Bounce piston, right, compresses air, storing energy for power cylinder stroke.

Actually, power is produced with about half the fuel needed in many conventional gas turbines. This depends upon the relative efficiencies. Many European gas turbines of the conventional type are in use at around 20 per cent efficiency as are certain railroad gas turbines in this country.

By successfully combining the operating characteristics long sought in driving high-speed machinery, Cooper-Bessemer foresees this development as a practical approach to relieving rising operational costs. Now, industry can have the benefits of smooth rotary turbine power yet with the fuel economy of the finest diesels and gas engines.

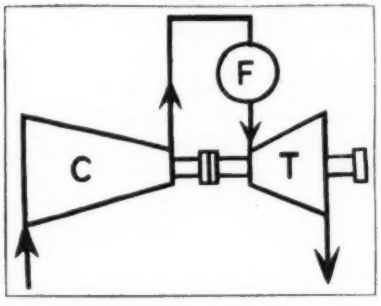
Also, with the free-piston engine turbine the efficiency will remain at a high level regardless of variations in load. Conventional gas turbine efficiency drops off drastically as loads are reduced.

What's the background of these units? Is this something new?

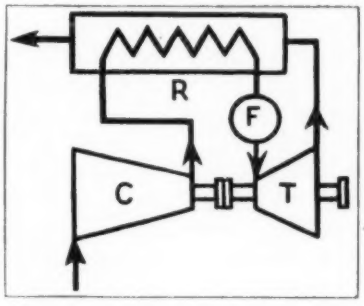
Well, the gas turbine itself is, of course, nothing new in the power field, in fact, the priciples dates back to antiquity. Gas turbines have been in use on jet aircraft for many years. Commercially, over 49,000 hp is already installed or scheduled in this country's electric generating plants. Many thousands of horsepower are in other uses and in turbochargers. In foreign countries, the total exceeds 245,000 hp.

The principle of the free-piston engine has also been known to power engineers for a long time. Practical usage began in Europe. During World War II, they were used in submarines for supplying high pressure air to discharge torpedoes. The Navy has been interested in the cycle for a long time, but has not put forth the kind of effort found in aircraft development due to lack of extreme urgency.

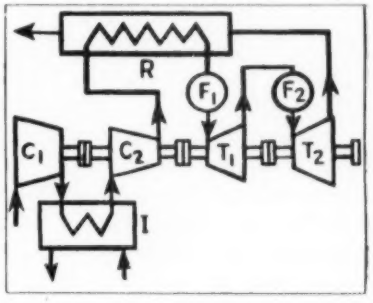
Alert to the need for efficient turbine machinery for some time, Cooper-Bessemer undertook as part of its overall developmental program a project to investigate the free-piston engine. We now feel that our long range planning is going to pay off in fulfilling needs in the power fields that we now serve.



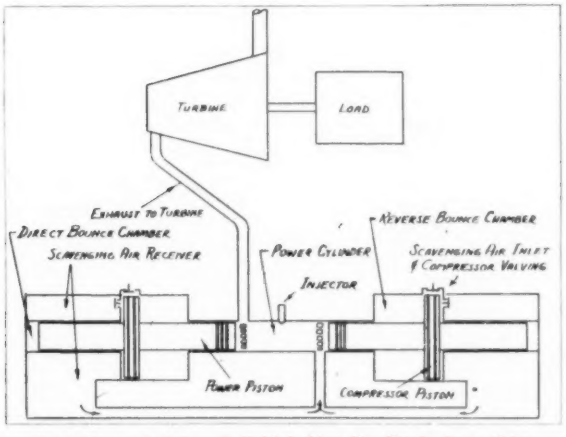
Simplest form of conventional gas turbine. "C" is compressor; "F", the combustor; "T", the power turbine. Free piston engine would replace "C" and "F" and similar and associated items in more complicated systems.



To improve thermal efficiencies, compressor air is heated in the regenerator; "R", by the exhaust gasses before entering the combuster, thus reducing the fuel requirements.



More elaborate system with intercooler, "I", to improve efficiency of "C_2"; and reheat cycle with another combustor and turbine, "F_2" and "T_2". Free-piston unit would replace all but a turbine and show greater efficiency.



Illustrating principles of Baldwin-Lima-Hamilton's free piston-gas turbine design. Piston synchronization (not shown) is accomplished by two racks, each attached to a compressor piston and engaging opposite sides of a pinion gear. Direct bounce chambers store energy for return stroke which is controlled and cushioned by the reverse bounce chambers. Here, compressor output is used for savenging and increasing the mass flow of gasses to the turbine.

From an engineering viewpoint, why is the free-piston engine turbine so much more advantageous than the ordinary gas turbine?

There are a number of reasons. First, the basic difference between existing gas turbines and this type of unit is in the method used to supply the turbine with heat energy for conversion to rotary power.

In the conventional gas turbine, air for combustion is compressed by a rotary-type blower. This is driven from the shaft of the gas turbine itself. After the air is compressed, fuel is burned in a low-pressure combustion chamber. This added heat increases the temperature of the air, expanding it to propel the turbine. Thus, we have low-pressure combustion at very high temperatures, and in simple cycles, a great deal of heat is wasted out the exhaust. Also, the conventional unit must drive its own rotary compressor.

In a simple gas turbine producing, for instance, 5000-

net hp at the output shaft, actually about 15,000 hp must be produced by the turbine's rotor. Approximately 10,000 hp must be taken from the gross horsepower to drive the compressor.

By contrast, combustion in the free-piston engine takes place at very high pressures and temperatures and the full expansion work is taken out of the cycle. The engine itself replaces both the rotary compressor and the low-pressure combustors, supplying hot gas under pressure to the turbine.

Operating temperatures are an important engineering consideration. The cycling of the air through the free-piston engine's cylinder helps to keep it cool and lowers the temperature of the gases going to the turbine. Combustion takes place at high temperature and pressure in a water-cooled cylinder permitting operation with a high overall efficiency, with exhaust gas being discharged at 1000°F after it has been expanded partially to compress its own air.

This is in contrast to the high temperatures required to gain relatively inefficient operation of conventional gas turbines that are around 1350°F to 1500°F at the present time. High component life at these temperatures is dependent upon the use of the "super alloys".

One great advantage of operating as low as 1000°F is that the turbine can be manufactured of materials proven in steam practice. Such materials are normally available for civilian use and can be easily manufactured. The higher temperature alloys needed for other type gas turbines are still, and probably will remain, on priority lists for a long time for military or other special uses. And engineering-wise, the "creep" characteristics of high temperature materials stressed under high speeds and at high temperatures is a problem that has confronted metallurgists for years.

What about the new alloys that are currently under development? How will these affect the picture?

Like yourself, we have heard the talk that the advent of commercial high temperature turbine materials will result in high efficiencies obtained from simple, inexpensive continuous-combustion turbines. As a matter of fact, temperature increase alone will account for only a small increase in efficiencies above present operating levels. The major field for improvement lies in devices for salvaging heat losses.

In view of the 1000°F operating temperature of the free-piston engine turbine, higher temperature will have no effect on its operating economies.

These devices to salvage waste heat; what's the story?

Well, there have been a number developed to get more efficiency from the conventional rotary compressor-type turbine. Regenerators (large gas heat exchangers) are used to recover waste turbine exhaust heat to help heat the combustor air. This heat supplements the fuel burned. When compound turbines are used to gain pressure and efficiency, intercoolers between the compressors provide the second compressor a denser medium with which to work.

On the turbine side, gases may go through a reheat before entering the second turbine. This amounts practically to another complete turbine plant. All of these devices are bulky and expensive. A point is reached where diminishing returns limit the use of expensive equipment.

The free-piston engine turbine, on the other hand, does not need the regenerator; it uses the exhaust energy in the turbine itself. Intercoolers are not needed nor is a reheat procedure necessary. It is, of course, possible to burn extra fuel in the exhaust line before the gases reach the turbine in order to gain high overload capacity.

Where do you go from here?

From what we know about the free-piston engine turbine, we in Cooper-Bessemer feel that its development will accelerate preference for gas turbines in central station operation as well as for general industrial power. While present plans call for units having capacity from 5000 kw to 15,000 kw, the time will come when larger sizes of free-piston engines are developed.

The free-piston unit adapts itself to gas turbines of practically any size. A number of units can be grouped as gas generators driving a single gas turbine. One or more units can be added or cut off the line for meeting various load requirements.

Power generating stations in water-hungry areas will be helped by the simple cooling of free-piston engines. Embodying the same conventional water-jacket cooling of internal combustion engines, little water make-up is needed as cooling is accomplished by a closed system using fans and radiators.

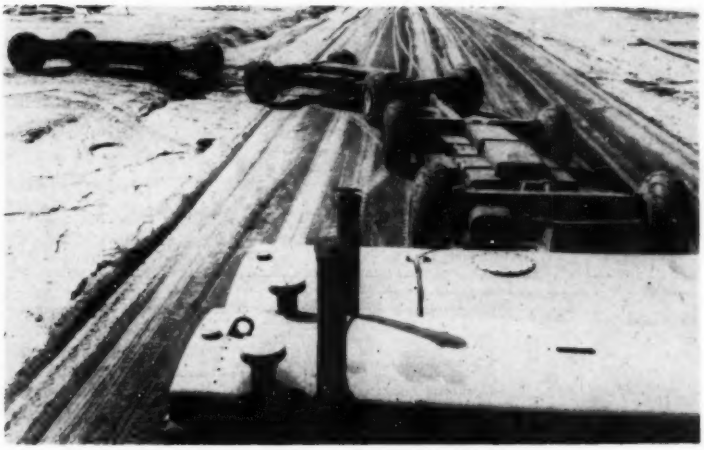
In addition to the uses mentioned, we visualize its use in pipeline pumping, in powering vessels where it can offer important economic weight and space savings, and in railroad use. Combining the fuel efficiency of the diesel with the advantage of turbine drive, we foresee our turbine on locomotive service, probably without electric drive.

Just where does this development stand today? Is it ready for the market?

We are naturally optimistic about the development, but we would like to sound a note of caution. There is still much to be done by way of field testing before the units will be actually released for production.

Incidentally, the free-piston engine offers no new production problems to us. As far as the gas turbines are concerned, we have been building exhaust-driven superchargers for many years and have gained long experience in that field. After all, in this application the power turbine is nothing more than a large supercharger taking all of the exhaust gas and converting it into useful work directly rather than indirectly by increasing combustion pressures for transmission through a crankshaft as has been the ordinary practice.

Until variables are fully solved, we are cautiously restraining final release on the unit. When all of the answers have been service-proven, the designs will be confirmed for manufacture and sale to industry.



At left, looking back from the locomotive across the engine hoods on the rear deck, three of the freight cars can be seen — each tracking the previous one. Below, the locomotive with cars behind, compared to an ordinary passenger car.

Rubber-Tired Freight Train

A TRAIN that needs no tracks, designed for off-highway use in undeveloped areas, has been introduced by R. G. LeTourneau, Inc. The Tournatrain, as it is called, consists of a locomotive and freight car combination. It is capable of economic operation over rugged terrain such as might be found in undeveloped areas. Large high-flotation tires enable the Tournatrain to transport freight over soft desert sands or rough dozer trails.

Basically, its operation resembles that of a diesel-electric locomotive in that power supplied by an engine generator set is transmitted to traction motors. However, the main difference between the Tournatrain and a conventional freight train lies in the traction motors or "electric wheel".

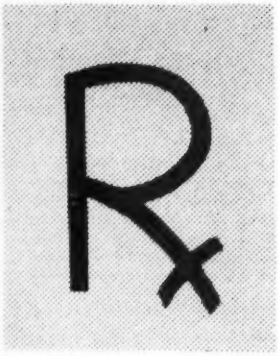
According to Mr. LeTourneau, the heart of the Tournatrain is the electric wheel which mounts large tires and contains a traction motor and gear reduction. Each wheel is self-propelled. The Tournatrain locomotive does not pull the cars as would an ordinary diesel-electric railroad train. Every car of the train pulls itself. The locomotive just supplies the electricity and leads the way.

Each car is coupled to the car ahead in such a way that it follows in the same tracks. By an automatic steering device, the path of the locomotive is duplicated in its turn by each car of the train so that the locomotive can make a right angle turn and every car will come up to the same spot and make the same turn.

When required, the rear wheels of the cars can also be used for auxiliary steering. Dynamic braking does away with brake shoes and slows the train in the same manner as the dynamic braking on a railroad locomotive, with the exception that all wheels of the Tournatrain contribute braking effort. An automatic spring-loaded brake is provided for emergency.

Included also in the Tournatrain's capabilities is its ability to climb steeper grades than an automobile. From present indications, this trackless train will see extensive service during the development of the Peruvian interior.

A rear view of one of the freight cars shows the electric wheel. When required, auxiliary steering is provided by rear car wheels.



Lube Oil Difficulties with Bunker C Fuel

By Robert Dodd Chief Engineer, Clay Electric Cooperative, Inc.

In the April, 1953 issue, there appeared an article entitled "Two Years with Bunker C Fuel." Mr. Dodd was the author. In the earlier article he dealt with the evolution of a satisfactory method of fuel preparation. This is another phase of the same evolutionary period relating to lubrication difficulties, particularly as they affected engine deposits and sludging. We would like to repeat from the introduction of the earlier article ". . . every installation will require some 'tailoring' despite the best attempts at an original sound engineering approach." To this we would add that there is apparently no "typical" case; this is Mr. Dodd's report on what he encountered and how he approached solution to his problems. Under different circumstances, other procedures and equipment might be perfectly satisfactory as Mr. Dodd, himself, states—Editor.

IN a previous article entitled "Two Years with Bunker C Fuel," I mentioned a gross profit of 4 mills per kwh was realized as a result of burning this low-grade fuel. The article also said that use of the fuel was well worthwhile "if the troubles that threaten to eat up the savings are controlled or eliminated."

Bunker C was burned for eight months in 1951 and the gross profit was $24,822.65. But the overall production cost per kwh dropped only 0.793 mills from the overall cost in 1950. The gross profit is the saving in the fuel purchases. Light fuel cost $0.1074 per gal and the Bunker C cost $0.0594. However, other costs went up so that the net profit was only $15,978.20 out of $24,822.65.

To arrive at this net figure, the cost of power for 1950 which was 9.914 mills per kwh was used for the 1951 output of the plant with Bunker C. This is not quite accurate as there were some changes from the 1950 prices in 1951. But it is probably the best estimate that can be made because the lube oil trouble to be discussed here led to other expenses besides the extra lube oil purchases. The expense of filters is directly connected to the condition of the oil in the engines.

Nature and Severity of the Trouble

The trouble with the lube oil was rapid deterioration of its condition which, because of its effect on normal engine functioning, required an excessive amount of makeup. The effect of Bunker C on the lube oil became apparent at once and got worse until the remedy was found. The cost of lube oil for the whole plant expressed in mills per kwh tells the story plainly. The condition of the engines also reflected the same story. But only the operators who lived with the engines can tell the seriousness and extent of this trouble.

When the engines reached their dirtiest condition because of what was happening to the oil, the operators had to start in the middle of the afternoon to get the engines on the line for the evening load. They had to watch each engine continually for signs of rings sticking, and be ready to swing the load to other engines while the rings worked free at light load. None of the engines would pull full load for more than a few minutes and usually could not be depended on for over three-quarter loads.

Incidentally, when references in the text are made to "dirt," it applies to carbonaceous materials, hard and soft: gums, varnish and lacquers; sludges; fuel soot; etc. In short, it applies to all the engine deposits that are generally the result of contaminated and dirty lube oil.

In 1950, before Bunker C was used for fuel, the cost of lube oil was 0.478 per kwh. It averaged 0.438 in the first four months of 1951 until Bunker C was burned continuously. After May to the end of the year, the mills per kwh averaged 1.051. Even this does not tell the full story.

Lube oil difficulty started at once and got worse as the lube oil condition grew worse. In April, the mills cost per kwh were 0.433. For May, it was 0.884. In June, there was a slight decline. We have assumed that this was because the unusual amount of make-up oil partially restored the condition of the crankcase oil in the engines. In June, the cost was 0.640. July and August costs were almost the same as for May; they were 0.818 and 0.879 respectively. September costs were higher, 0.933 and for October higher still, 1.402.

In November, the costs reached their highest, and the condition of the engines was so bad that it was almost impossible to keep them on the line. For November, the lube oil cost was 1.587 mills per kwh or about three and a half times the cost for the month before Bunker C began to be used for fuel.

Some Trouble Anticipated

To some extent this trouble had been anticipated. In the fall of 1950, the plant was changed from straight mineral lube oil to a heavy duty detergent type. Also, a centrifuge was purchased. The centrifuge began operating on April 11, 1951, and until the middle of June, it seemed to be making the lube oil cleaner. But the full-flow filter life had not been lengthened, and the engines were becoming much dirtier. By the end of June, the records showed that the centrifuge was removing as much dirt in the form of a rubbery paste as it had when first installed. Nineteen pounds of dirt was being removed in five days.

By the middle of July, parts of the engines were sticking. Barrels of No. 20 additive oil were added to the crankcases to reduce the viscosity in the hope that more effective washing would occur. No. 40 oil had been used since the change to additive oil in the previous fall. The No. 20 may have had some useful effect, but if it did, it only made it possible to go deeper into the trouble that deterioration of the lube oil condition was causing.

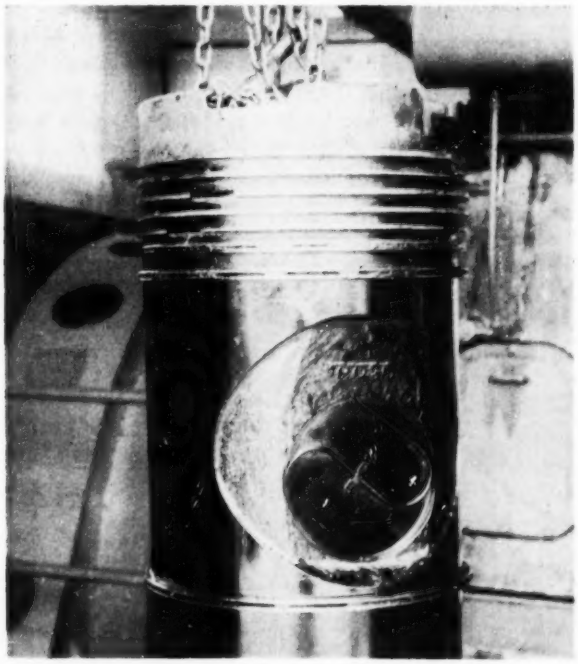
Some Remedial Action

By August 14th, it was perfectly obvious that the full-flow filter and centrifuge with the additive lube oil would never get us out of the difficulty. Large fuller's earth-type filters were then ordered for each engine. The engines' condition had become so bad that the installation of the filters was rushed as fast as possible, but they were not installed till the middle of October, 1951.

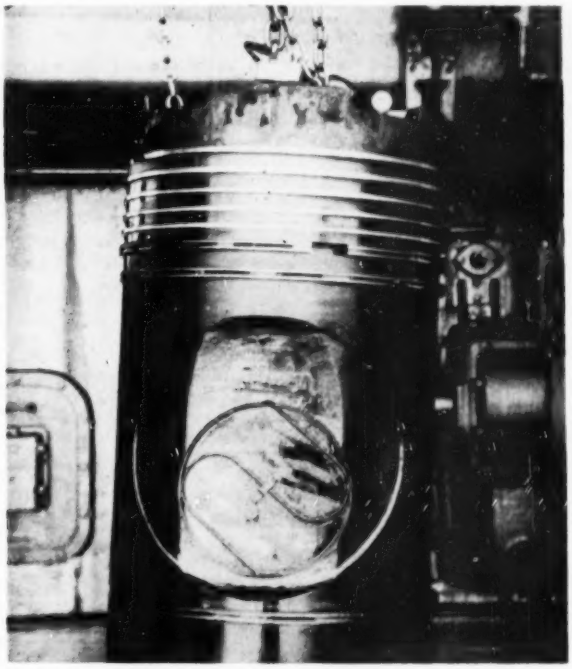
While the fuller's earth filters were coming, the conditions of the lube oil continued to deteriorate. By August 29, the centrifuge was catching 7½ lb of dirt per day. That rate of dirt removal was probably the maximum; conditions probably had gotten as bad as they could get. The excessive quantity of make-up oil was partially restoring the condition of the crankcase oil, and the engines could not be in worse condition and still carry the load. The centrifuge continued to catch from 7 to 7½ lb of dirt a day till the fuller's earth filters were installed.

Obviously, this deterioration of crankcase oil condition would have been arrested if we had changed out the oil, and started with fresh oil in the engines when the consumption began to get heavy. However, before the change to additive oil in the fall of 1950, no oil had been discarded from the plant for ten years. The crankcases had been drained frequently and refilled with either reclaimed or new oil, or a mixture of both.

This practice had proved satisfactory and it had been hoped that the additive oil with the certifuge backing up the filters would eliminate the need for reclaiming. It didn't work out that way. However, no equipment has been found that will reclaim an additive oil and leave the additive undisturbed. Therefore, when this hope was not realized, a special test run was made with one engine to find the cost of changing out an additive oil often enough to keep the



A piston from the test engine at the end of three runs on additive oil with only a 25 micron full flow filter—3641-hr run.



Piston after 2427 hr of operation on straight mineral oil. Full flow filter and fullers earth filter were used for this test.

engine in good condition, and the make-up oil to a reasonable amount.

Additive Oil Changeout Results

The engine set aside for the test run with additive oil was completely overhauled. The pistons were changed to a new type, new rings were installed, and the cylinders were honed.

The test engine was equipped with a full-flow filter only. It was packed with 25-micron particle-catching elements. The centrifuge was not used. The thoroughly-cleaned engine was filled with new heavy-duty detergent type No. 40 partly napthenic lube oil. It ran 1340 hours before the oil was considered too dirty for further use. 102 gallons of make-up were added. This was new oil poured in directly from barrels and measured carefully. The overall figure including the first fill of oil and the make-up, was 3830 hp hr per gal of oil for this first test run. As far as the test was concerned, the crankcase drainings were thrown away.

The sump tank was wiped out and the engine refilled with the same kind of new oil. The engine ran again until the crankcase oil was so dirty that it obviously was leaving dirt in the engine. This run was only 964 hours, and worked out at 2244 hp hr per gal of oil overall. The third run lasted only 837—a thousand hours less than the first run, and oil was used at the rate of 1925 hp hr per gal. At the end of each run the full-flow filter was repacked, but the engine was not washed out inside.

The progressively shortening life of the oil—1340, 964, and 837—is explained by the working hypothesis that the additives in the oil and the filter set up could not adequately cope with the rate of dirt formation and that engine deposits were rapidly building up and interfering with normal engine functioning, particularly with respect to the piston rings and their effect on oil control.

At the end of the test run an inspection of the engine was made. The accompanying picture shows the condition of a piston at the end of the test. The scraping edges of the oil rings were completely clogged with dirt. The engine had only a little dirt that could be wiped off the parts.

Results with New Filters

Effect of the change to fuller's earth filters became apparent at once. The mills per kwh dropped from a high of 1.587

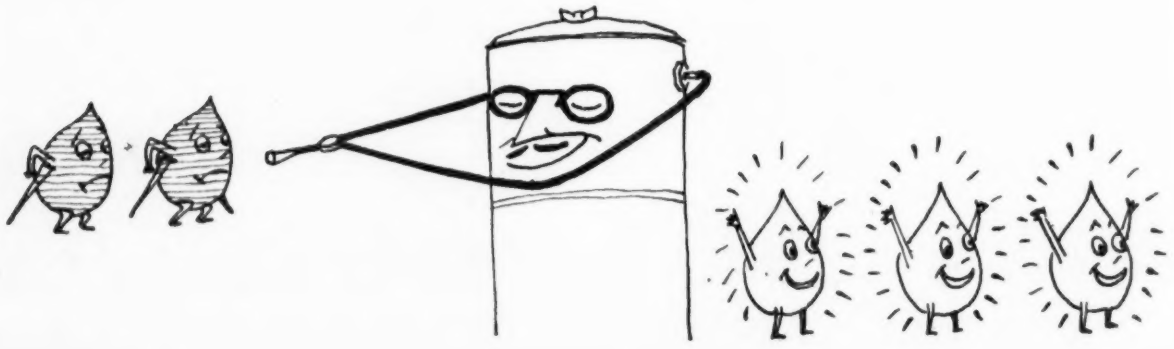
for November to 1.209 for December, 1951. In January of 1952, the full effect of the fuller's earth and the fresh lube oil was shown in the engine testing additive oil by the very low figure of 0.321 mills per kwh for the whole plant.

While the work of overhauling this engine for test was going on, the other engines were operating as they had been, using the fuller's earth filters and the additive oil. By now the additive level was so depleted that the oil was in effect a straight napthenic mineral oil.

The load-carrying ability of the engines had not improved very much but the make-up rate dropped from 900 hp hr per gal to 1145 in one engine with no changeout of the crankcase oil. Another engine showed the same effect from oil in good condition. It was refilled twice before it was overhauled. At each refill, its make-up rate dropped from 1000 to 1700 hp hr per gal.

By this time, we realized that we had to do whatever was necessary to keep the oil clean in spite of a high rate of dirt formation. One engine had been using straight mineral oil. It was fitted with the same type of 25-micron full-flow filter mentioned before and used a fuller's earth bypass filter having half as many pounds of fuller's earth as there were gallons of oil in the crankcase.

The engine had three refills of new oil but reclaimed oil was used for makeup. Since the oil changed out could be reclaimed, the overall oil consumption of the engine worked out to 6683 hp hr per gal. A piston was pulled from this engine for comparison with that of the engine used to test the economy of change-out of additive oils. The condition is relatively good as can be seen.



Filter Notes

The difference to the lube oil between operating with regular distillate and residual fuel can be seen from the figures for the life of the fuller's earth filter packs in the Co-op's two plants. In the Keystone plant where residual fuel is burned, the filters averaged 237 hr between changes. At the Co-op's other plant where light fuel only is burned, the filters have reached the remarkable life of 2600 hr.

In both plants the engines are the same make and model and so are the filters. The full-flow filters also show a remarkable difference in the two plants. With the heavy fuel, the full-flow filter lasts from a third to a fifth as long. The average life varies from engine to engine. One engine averages 943 hours to a pack while another similar engine averages only 529 hours.

This difference to the lube oil, showing up in filter costs, is due to the different natures of the fuel. It is not merely that Bunker C has more free carbon and is harder to burn with a clear exhaust but the fact that it has everything in it that is considered bad for the lube oil. Where lube oil is made by an expensive refining process, Bunker C is not made at all; it is what is left when all of the high-priced products that are economically feasable to take out of the crude are removed.

Thus, when Bunker C gets into the crankcase, either by direct leakage or past the piston because of poor burning conditions, the effect of the lube oil refining process is offset. All of the contaminants in the Bunker C that are impractical to remove during fuel preparation cause lube oil deterioration. By contrast, light fuel is a relatively highly-refined fraction of the crude. Its principal effect when mixed with the lube oil is to cause dilution.

The presence of a very little light fuel in lube oil is determinable by the marked change in viscosity. Detection of Bunker C is more complicated since its viscosity is very close to or may even exceed that of the lube oil. So far, we have not found a test that will indicate the presence of Bunker C in lube oil until there is over 5 per cent contamination. Color is one practical indication providing that the lube oil itself can be kept visually clean.

With more conventional fuels, color of the lube oil is not necessarily an indication of its suitability for continued use but in our case we have to use it as an indicator of Bunker C contamination. When the oil has darkened, it may be due to Bunker C contamination or loaded filters, both being conditions requiring reclaiming. Therefore we change-out the oil. It is our practice to change-out the oil at this time. We feel that this should be done rather than repack the filters. The fuller's earth filters are being used to keep the oil clean by removing the contaminants as they are formed and we do not think that the added job of cleaning up the darkened oil should be imposed on them. This is a reclaiming job that can better be done outside of the engines.

Conclusion

While this article may sound as though we have found straight mineral oil and fuller's earth to be the only answer, we do not mean to give that impression. Under our load conditions where three 1000-kw machines must make over a million kwh per month, we have been driven to the straight mineral oil and the fuller's earth in great quantities. Under other conditions, if a different filtering arrangement can remove the sludge faster than the engine forms it, there is no reason why heavy-duty detergent-type lube oils would prove unsatisfactory.

It is our conclusion that the filters must be able to remove all the kinds of sludges faster than the engine makes them or the filters will be hopelessly behind the eight ball and costs will mount for lube oil and for engine maintenance.

What Do You Know!

Here are more questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 78 to check them.

1. When flexible couplings are used, the degree of misalignment is of no importance.
   a. True b. False

2. Which of the following functions do not apply to the use of flexible couplings? Consider all of the various types.
   a. To compensate for parallel misalignment
   b. To compensate for angular misalignment
   c. To provide torsional vibration isolation
   d. To compensate for axial misalignment
   e. To function as universal joints

3. The only function of seals in a lubricated flexible coupling is to retain the lubricant within the coupling.
   a. True b. False

4. A free-piston engine is one in which:
   a. The piston pin is full-floating
   b. The piston is free to rotate on a piston pin carrier.
   c. The pistons are not connected by rods to a crankshaft

5. A factor in achieving high thermal efficiency from fuel is to burn it at high pressures.
   a. True b. False

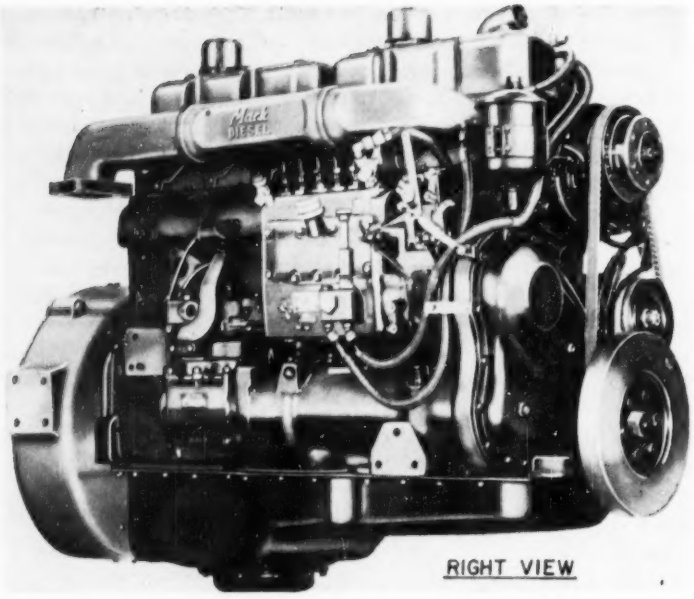
6. The exterior of nozzel tips, particularly around the orifices, should be cleaned and polished with:
   a. Steel wool c. Emery cloth
   b. Crocus cloth d. Wire brush

7. In a plant burning heavy fuel would you expect lube oil filter life to-be—
   a. Longer b. Same
   c. Shorter

8. In an engine burning fuel contributing substantially to the rate of dirt formation within the engine, when the oil becomes dirty, new filter elements should be expected to clean it up and keep it clean.
   a. True b. False

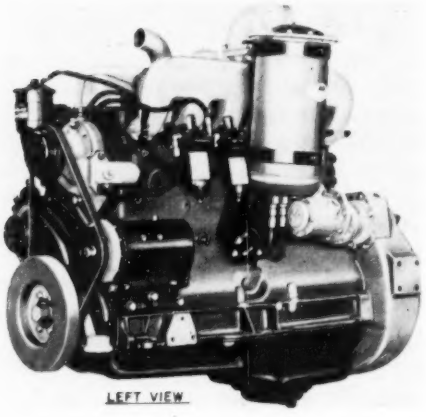
9. On which of the following railroads was the first diesel-electric switcher used.
   a. Santa Fe c. Long Island Railroad
   b. Pennsylvania d. Jersey Central

10. Diesel-electric locomotives are famous for high availability. Utilization then becomes important and is most difficult to accomplish which of the following is involved:
    a. Long-haul freight and passenger service
    b. Short-haul freight and commuter service



RIGHT VIEW

Illustrated in the right-side view of Mack's Thermodyne diesel are the injection pump and governor, air compressor, fuel filter and viscous vibration damper. The left-side view shows lube oil filters, air starter, water pump, generator and one-piece aluminum intake manifold attached to head.



LEFT VIEW

Mack's Thermodyne Diesel

Culminating several years of extensive research, Mack Trucks, Inc., announced the development of the Thermodyne Model END-673—designed specifically for installation in Mack vehicles.

SEVERAL interesting design features are incorporated in the Thermodyne diesel. It is of 4-cycle, in-line design having six cylinders of 4⅞-in bore and 6-in stroke. Piston displacement is 672 cu in and the compression ratio is 16.59:1. A maximum torque of 430 ft lb is developed at 1200 rpm.

Extensive tests in both the laboratory and operation in the field indicate that the engine has a fuel consumption rate in the order of .39 lb per bhp hr at 2100 rpm with maximum fuel economy realized at 1400 rpm. According to Mack, the primary reason for the engine's fuel economy lies in the design of the combustion chamber.

Formed entirely in the piston crown, the combustion chamber is semi-toroidial in shape with an essentially flat cylinder head surface. Design of the intake port imparts a tangential direction of flow to the incoming air which results in a swirling movement in the combustion chamber. As the piston rises, the semi-toroidal piston crown accelerates the swirling air into a high velocity vortex providing better fuel-air mixing.

Mack states that in addition to affording complete combustion, the Thermodyne combustion chamber assures more efficient injection nozzle cooling. Pistons are designed to eliminate hot spots by reducing heat concentration in the piston head, while the compactness of the combustion chamber with its reduced heat rejection surfaces is said to increase engine efficiency.

Fuel injection equipment consists of a Model APE multi-cylinder Bosch pump and hole-type hydraulically-operated nozzles. The injection pump is of the cam-actuated, constant stroke, lapped plunger type and mounts a self-regulating, variable, plunger-type transfer pump equipped with a hand-priming unit also of the plunger type. The priming pump is located on the inlet side of the transfer pump.

Fuel pump drive is directly from the timing gears and is flange-mounted to the timing gear case. The 4-hole injection nozzles are water-jet cooled. Injection is controlled by a variable-speed hydraulic centrifugal governor to produce an engine speed corresponding to the position of the accelerator. The governor is designed to automatically compensate for variations in load placed on the engine.

In addition to the torque control and speed droop characteristics, the governor completely shuts off fuel when the engine is drifting. While this action results in some fuel savings, it is much more important as a control and safety factor since it permits full utilization of the engine braking effect.

Also incorporated in the Thermodyne diesel is the

"Synchrovance". This unit automatically advances or retards injection timing according to the engine speed, aiding in the elimination of premature firing at low speeds and providing maximum advance as speed increases. Smooth running, full power development and economy are claimed as a result.

Construction

Rugged construction has been used throughout the engine. The seven main bearings are supported by heavy, webbed bulkheads in the upper crankcase which is cast integral with the block. The crankshaft, drop-forged from heat-treated medium carbon steel, is both statically and dynamically balanced with counterweights integrally forged. Crankpins are bored to facilitate cooling and increase the effectiveness of the counterweights. Journal fillets are pre-stressed by rollers to increase surface strength. Torsional vibration is absorbed by a viscous-type damper mounted on the forward end of the crankshaft. All journals are Tocco case-hardened.

Main bearing journals have a diameter of 4 in and connecting rod journals are of 3-in diam. Thin shell copper-lead precision-type bearings with a steel back and babbitt overlay are used for both main and connecting rod bearings. Projected total areas for main and connecting rod bearings are 42 13/16 sq in and 34 5/16 sq in respectively.

Connecting rods are drop-forged of chrome-molybdenum steel. Caps are split at a 35-deg angle to accommodate the 3-in crankpins and still permit withdrawal of the rod through the bore. Mating surfaces of the cap and rod incorporate a tongue and groove feature designed to relieve retaining screws from shear.

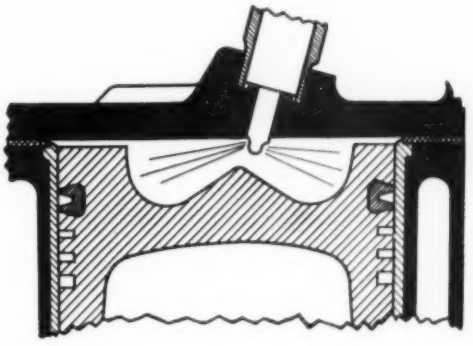
Timing gears, five in all, are up-set end-grain drop-forgings. After the helical teeth are generator ground and lapped, gears are case-hardened.

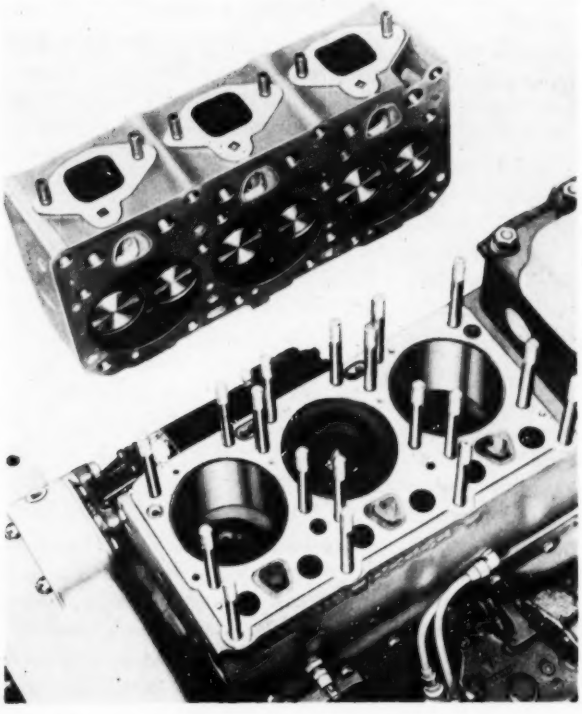
The balanced centrifugal water pump, mounted on the front of the engine block, is belt-driven from the crankshaft. To resist corrosion, a bronze impeller and nitrided steel shaft are used in pump construction. The shaft runs in sealed ball bearings. Water seals are greaseless and packless, thus requiring little attention.

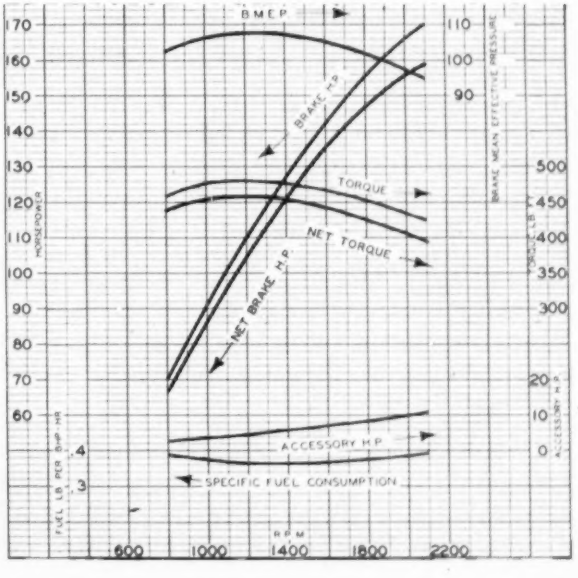
Illustrated at right is the Thermodyne combustion chamber, showing inclined position of the injection nozzle and spray pattern.

Below, with one head removed, the flat head and semi-toroidal shape of the combustion chamber in piston crown can be seen.

At lower left are performance curves for the Thermodyne diesel.







DIESEL BRIEFS

Diesel Increases Locomotive Crane Efficiency

Conversion of two locomotive cranes from steam to diesel power has increased stockpiling and yard hauling efficiencies and materially reduced operating costs for the Coggins Marble and Granite Industries, Inc., of Elberton, Georgia.

The company, which has operated one of the largest granite quarries in the South for 50 years, reports substantial reductions in fuel costs and the saving of 1½ hr of starting and hosteling time per crane per day. These savings are attributed to the greater operating efficiency of the diesel over steam power and the fact that the diesels, with electric starting, are ready to go at the press of a button.

Cranes operate as locomotives in moving loaded cars and switching empties. Formerly, when pushing as many as four loaded cars, they had to "bump" their way up grades, according to company spokesmen. But now, with diesel power operating through torque converters, they provide smoother movement of the cars.

Diesels selected to replace the steam units were 4-cyl, 2-cycle GM engines with GM torque converters. Installations were made by the Blalock Machinery and Equipment Company, Detroit Diesel Engine Division distributors at Atlanta, Georgia.

Link-Belt Opens 18th Plant

A new 72,000-sq ft engineering plant for the design and manufacture of conveying and processing equipment has been completed by Link-Belt Ltd. at Scarboro, Ont. This is the second plant the parent company, Link-Belt Co., has placed in operation in a year. It becomes the company's 18th plant.

NYC Celebrates Centennial

The New York Central Railroad recently celebrated a century of progress since its company name first appeared on the American scene. In July 7, 1953, ten small railroad companies spanning midstate New York were consolidated to form the new company. Among assets they pooled were their 154 wood-burning locomotives.

Symbolizing and climaxing the century of progress, the road, a few months from now, will end the use of steam locomotives on its 2800 miles by replacing the last of its steamers with diesel-electric giants. Before 1953 ends, all service east of Cleveland and all passenger service east of Detroit are scheduled to be diesel-powered. This will be made possible by completion of deliveries of 164 diesel-electric units costing $27,500,000, bringing its diesel ownership to 2113.

Aeroquip Expands Facilities

Aeroquip Corp. announces it has acquired the year-old Van Vert, Ohio plant of Sterling Electric Motors, Inc., situated 100 miles south of its main plant at Jackson, Mich. The acquisition of the plant will enable the company to consolidate different warehouse locations into one easily controlled unit, it was stated, and Aeroquip will have adequate manufacturing facilities for the production of its new products.

English Diesel Firm is 21

F. Perkins of Peterborough, England, which recently installed diesels in London taxicabs, has just celebrated its 21st birthday with a $5,600,000 factory extension. Output of the company is stated as 4,000 engines a month.

New Bosch Service Agencies

American Bosch Corp. recently appointed four companies as authorized agencies for its fuel injection equipment line, as follows:

Eastern Diesel Service Co., Portland, Maine; Specialized Service Co., Klamath Falls, Ore.; Boston Fuel Injection & Engine Service, Boston, Mass.; and, North American Diesel Injection Co., Philadelphia, Pa.

Metallurgy Research

Dr. H. Kellogg, associate professor of moneral engineering at Columbia University, has started work on a comprehensive series of graphs which will combine and expand information con-

DIESEL BRIEFS

stantly needed by engineers who work with metals. It will take two or three years to complete the series which will plot free-energy of formation against temperature for such metal compounds as oxides, sulfides, carbonates, etc.

Although Professor Kellogg is particularly interested in the extraction of metals from their ores, the graphs will simplify the prediction of how metallurgical reactions proceed for a wide variety of industrial applications. At present, metallurgists and chemical engineers must search the literature for each specific example of the effect that temperature has on the reactions.

B&O Buys More Budd RDC's

The Baltimore & Ohio Railroad has ordered five self-propelled rail diesel cars from the Budd Co., it was announced. The road already has five of these cars in service. The new cars will be used in the Washington-Baltimore services. Three of the units are 89-passenger RDC-1's; the other two are RDC-2's, which accommodate 71 passengers and have a 17-ft baggage-express compartment.

Cobalt Radiography Training

Early this fall, Technical Operations, Inc. will offer the first in a series of two-week training programs in the use of cobalt 60 radiography in industry. Approximately half the time will be taken in lectures, demonstrations, and question and answer periods, the rest being devoted to actual practice, including experiments in shielding, radiation measurements, and the taking of radiographs.

Diesel Operators Institute

The University of Nebraska announces that it is planning to hold its second annual Diesel Operators Institute October 15, 16, 17. Tentative program includes the proper usage of fuels and lubricants, maintenance of fuel injection equipment, preventive maintenance procedures, relative economy of oil *vs.* dual-fuel engines, accessory problems, and bearing failures.

Case Introduces Diesel Tractor

A recent addition to the J. I. Case line of farm implements has taken the form of a 6-cyl diesel-powered farm tractor designated Model 500. The diesel engine is also Case-built and represents the culmination of several years of extensive research and development.

Injection equipment for the unit is of Bosch design. Injection pump is a constant-stroke, distributing plunger, sleeve-control type, actuated by self-contained cam and tappet arrangement which also carries gearing for the distribution function.

Three cylinder heads, each serving two cylinders, are employed in construction. Consequently, they are light enough for easy one-man handling. Starting is accomplished by means of a 12-v system using two 6-v batteries connected in series.

For cold-weather starting, a primer of the ether-capsule type is provided. Fuel is filtered in three stages, one cleanable and two renewable. In addition to the fuel filters in the line, a cleanable filter, filler-hole screen, and water trap have been installed on the fuel tank.

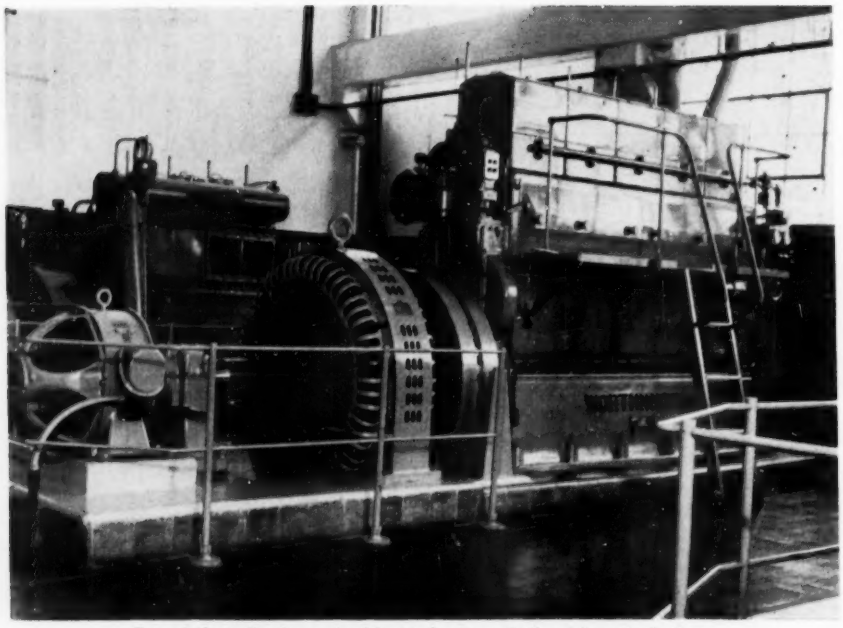
Chicago Pneumatic Buys Jacobs

Chicago Pneumatic Tool Co. announces that it has acquired the assets of the Jacobs Mfg. Co., manufacturers of Jacobs chucks.

Manufacturing and sales operations will not be affected by the sale, it was learned, and will be carried on without change by a new wholly owned subsidiary of the company called the Jacobs Mfg. Co. Present personnel and company policies will also not be altered.

Study Equipment Economics

A center to conduct education and research into the methods of industrial equipment acquisition and replacement will be established this fall in the business and economics department at Illinois Institute of Technology. The center, to be known as the National Center of Education and Research in Dynamic Equipment Policy, is sponsored by the Machinery and Allied Products Institute which will finance it during its initial years.



Two of three diesels on stand-by service in a Mexican cigarette factory.

Stand-By Power in Mexico

By W. J. Granberg

In Mexico, stand-by power units are important. Here are three typical installations—ready to go on the line should the main source of power fail.

IN Mexico, water for production of hydro-electric power is scarce. Since the flow is subject to seasonal fluctuations, stand-by power for supplying electrical energy is necessary for the uninterrupted operation of manufacturing plants. Large buildings, too, must have their private source of power to carry them through shortages or line failures.

Diesel power, of course, is the chief means by which stand-by generators are operated. In Mexico, total kw hr capacity of diesel generator units is considerable and the government reserves the right to cut them into the public power supply lines in event of emergency.

It is not only the limited and fluctuating flow of water that is a hazard to hydro-electric power production, but the lack of water storage facilities that places a distinct limit on capacity of output. Electrical storms, too, are a contributing factor in causing power failures.

Typical of these stand-by power plants is the Fairbanks-Morse installation in the Hotel del Prado in Mexico City, where two Model 32-E-14 diesel engines produce a total of 200 kw. The engines are 3-cyl units with a bore and stroke of 14-in by 17-in. With a rated hp of 225 at sea level, there is a loss of some 23 per cent, or 51.75 hp, in operation at Mexico City, an altitude of approximately 7400 ft.

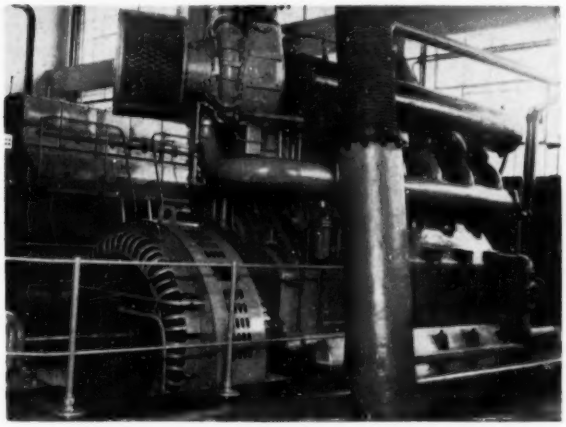
This means the two direct driven Type TGZO F-M generators are derated to 100 kw each, at that altitude. They produce 50-cycle, 3-phase, 250-v current. In an average year, they may operate continuously for 2 mo to supply power for the hotel, largest in Mexico City, plus shorter periods during failure of the public power line.

Starting air for the diesels in the hotel is provided by an F-M E-2 compressor, driven by a Type Z, 3-hp electric motor. The F-M excitors are belt-driven. Diesels are fitted with Burgess snubbers, Woodward governors, Burgess scavenging air filters and Honan-Crane lubricating oil filters. The switchboard is a Muhllenbach installation.

A cigarette-manufacturing company in Mexico City, Cia Manufacturera de Cigarros El Aquila, S. A., has a more elaborate diesel power installation in order to keep its plant, employing more than 650 people, in operation during public power shortages. Last year saw its diesel-powered generators operating for 6 mo in order to supply the necessary power required for continuous operation.

Here, there are three diesel engines, a Model CC-5 Worthington developing 206 hp at 428 rpm; a Model FS-13 Nordberg that turns at 500 rpm to develop 800 hp; and a 196-hp Deutz turning at 375 rpm. These figures are for the altitude at Mexico City, taking into consideration the power lost because of that elevation.

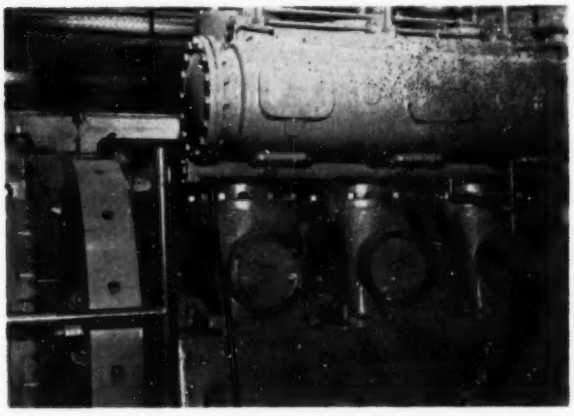
The 5-cyl Worthington is direct connected to a 146-kw Westinghouse AC generator, while the excitor is a 6-kw Westinghouse unit. The Nordberg drives a 575-kva Westinghouse generator and a 6.25-kw Westinghouse excitor. A 125-kw Westinghouse generator and Type SKDC Westinghouse excitor is driven by the Deutz diesel. All current is 50-cycle, handled through a Westinghouse switchboard fitted with Trumbill switches and General Electric air circuit breakers.



This Nordberg is one of three diesels in a Mexican cigarette factory. The other two engines can be seen on preceding page.

Stand-by power for a soft drink bottling plant is provided by this model 32-E-14 FM engine turning a 121 kva alternator.

At the Hotel del Prado in Mexico City, there are two of these 32-E-14 F-M engines on a stand-by basis in event of a failure.



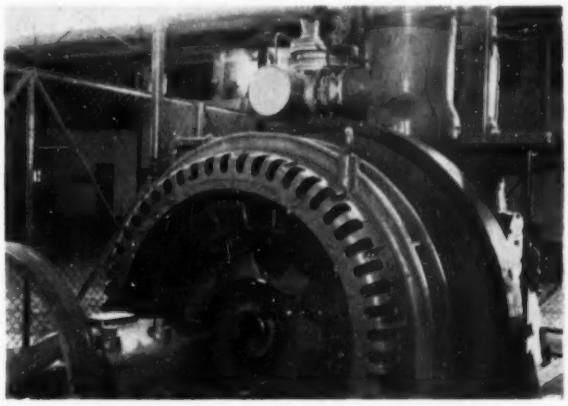
Transformers in the plant include two Type SL 3-phase Westinghouse units and two Vasteras Sweden. Other equipment in the power plant includes a Quincy compressor for supplying starting air, Type 3501-10 Blackmer pump for bringing fuel oil in from the storage tanks, Buffalo and Weisi water pumps, and Asea Sweden electric motors.

The Nordberg diesel is turbocharged with an Elliott unit. Both this engine and the Worthington carry Type UG-8 Woodward governors. Fritz Ellinghaus, engineer at the Cia plant, maintains the diesel powered generating plant on an alert basis that permits putting it to work at a second's notice if necessary.

Typical of the outlying manufacturing plants in Mexico, which depend upon hydro-electric power and have installed diesel-generator units to augment that source of supply, is one of the country's largest mineral water and soft drink bottling plants, Manantiales Penafiel, S. A., in Tehucan, Puebla.

The plant operates on 110 kw from the hydro-electric source, plus 80 kw from its diesel-powered generator. The main engine is a Model 32-E-14 F-M, a 2-cyl engine developing 150 hp at 300 rpm to turn a 3-phase, 240-v, 121 kva alternator.

A type E-2 F-M compressor provides air for starting and an F-M evaporative cooler is driven by a Master electric motor. Automatic Safety Control Co. controls are utilized. On stand-by status there is a D13000, 6-cyl Caterpillar diesel with Twin Disc clutch driving a 90-kva, 230-v Asea generator by belt at 1000 rpm. The excitor is a 115-v Asea.



Although Mexico's elaborate public power program is making rapid strides toward attaining the minimum output required for industrial, domestic and general use, the goal is still some distance away. Throughout the country diesel power is coming into greater use every day, not only for stand-by use, but to augment the main source of supply in event of shortages and failures.

Lack of water is the greatest handicap in agricultural development of the country. Here again diesel power is playing a part of inestimable value. Diesel-driven deep-well pumps are providing water for irrigation of once arid land. At the same time, they provide an economical and reliable source of electric power for general farm use.

It is the opinion of diesel engine distributors in Mexico City that no country in the world today is placing so much dependence on diesel power for economic and agricultural development as Mexico.

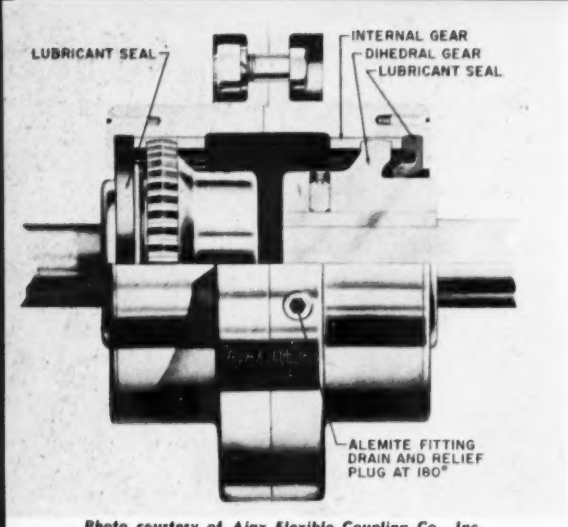


Photo courtesy of Ajax Flexible Coupling Co., Inc.

Ajax dihedral flexible coupling showing details of construction.

Lubricating Flexible Couplings

Know your flexible couplings — give them a break operationally, and service them properly.

By A. F. Brewer

Technical & Research Division,

The Texas Company, New York, N. Y.

MODERN flexible couplings are designed to transmit power over a wide range under sustained overloads, to be able to absorb shocks or vibration and to compensate for both axial, angular and parallel misalignment. Modern power transmitting installations are designed for as nearly perfect alignment as possible. Then, the load on the flexible coupling is minimum but due to structural conditions, more or less misalignment must be expected after the machine goes into operation. The coupling must anticipate this, and modern flexible couplings are designed accordingly.

Flexible couplings as originally designed derived their flexibility through the use of flexing materials such as springs, rubber bushings, or laminated pins. Later (mechanical type couplings were designed involving rigid parts such as illustrated in some of the accompanying designs.

When they came into use, the need for lubrication became apparent. It is important in order to keep the contact elements in the coupling as free from friction and wear as possible. In this way, their degree of relative flexibility will be maintained. With this type of coupling, the type of lubricant most suitable according to the design of the coupling, how it is installed, and prevailing operating conditions, must be determined.

Lubrication Prevents Overheating

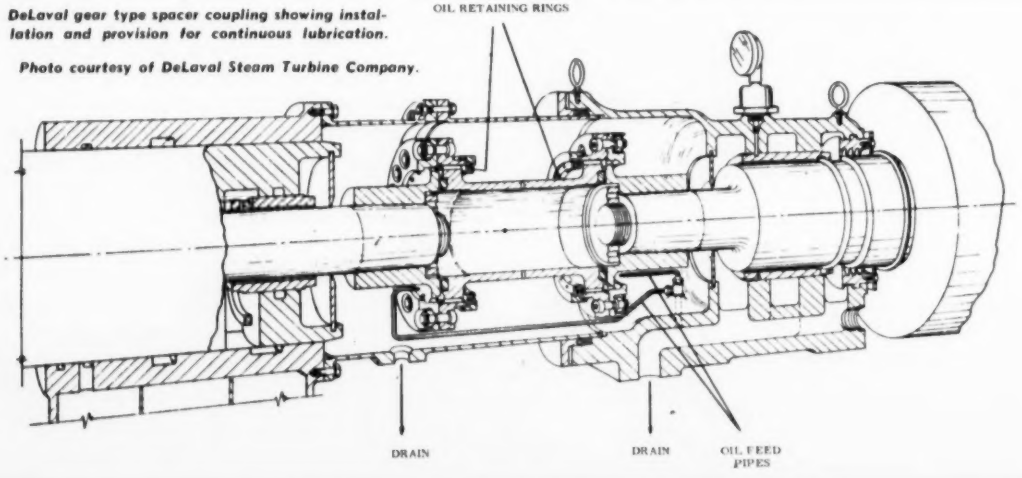
It is a fundamental feature of any type of coupling that it develops heat under misaligned conditions as a result of power absorption in overcoming misalignment. The amount of heat developed, or power absorbed, will depend upon the loads, the rubbing velocities of the contact parts, and the ability of the lubricant to keep the coefficient of friction between these parts at the lowest possible figure. But most important is the degree of misalignment.

Heat is rejected by conduction, radiation, and convection from the coupling members themselves, or by circulation of the lubricating oil, which in this case doubles as a coolant. Ultimate temperature of the coupling is determined by the difference between the rates of heat generation and rejection. It is important to recognize this possibility of heat generation and the dual role of the lubricant. In reality, the lubricant is the only factor which can be altered to reduce the final temperature in a coupling operating at high misalignment and high speed without making mechanical changes.

Effective lubrication therefore is a prerequisite if any type of lubricated coupling is to take care of the operating conditions. The life of such a coupling is virtually contingent upon the use of suitable lubricants and the extent of their containment in the coupling. Suitable lubricants,

DeLaval gear type spacer coupling showing installation and provision for continuous lubrication.

Photo courtesy of DeLaval Steam Turbine Company.



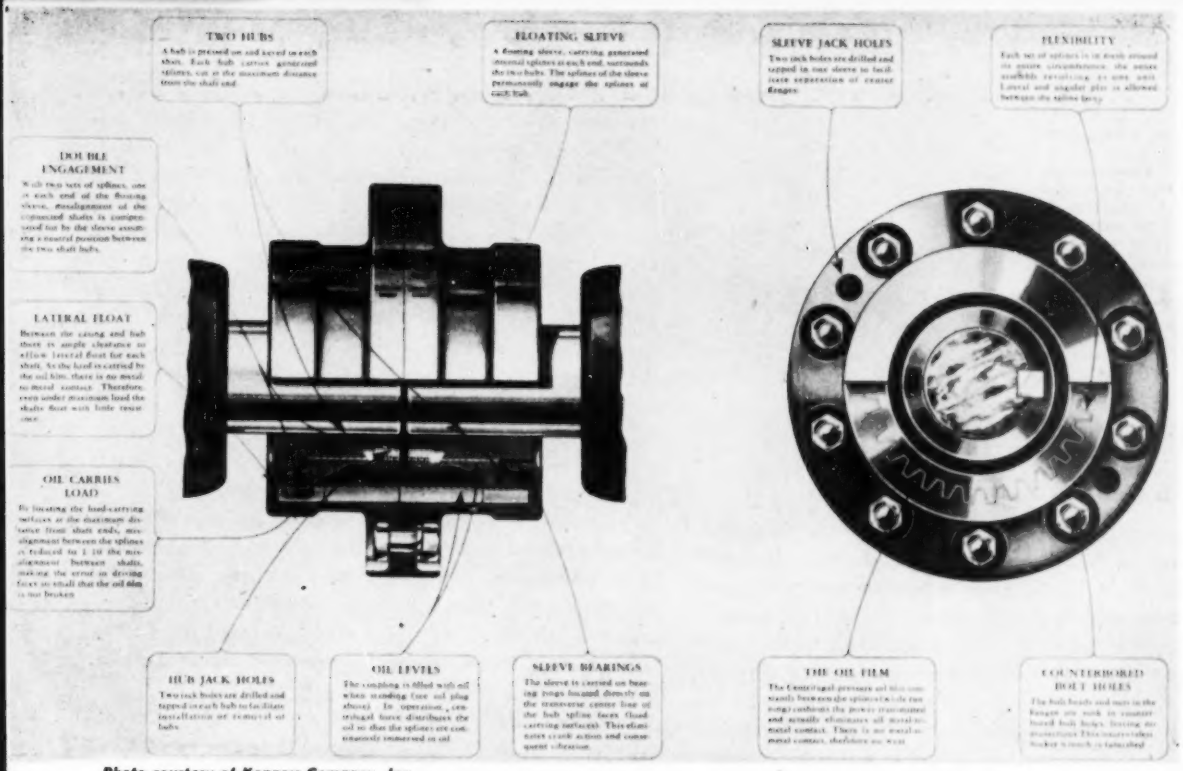


Photo courtesy of Koppers Company, Inc.

Principles of the Fast Self-Aligning Coupling. Outstanding feature design is positive lubrication. In operation the load-carrying surfaces are entirely submerged in lubricant.

plus good seals, go a long way in preventing coupling wear.

Flexible couplings designed for lubrication involve meshing annular gear teeth, flexible steel grids or springs, an arrangement of roller or link-type chains, or an intermediate floating element in the form of a cross. Lubricated couplings in turn are divided into two broad classifications as to whether they are lubricated by oil or by grease.

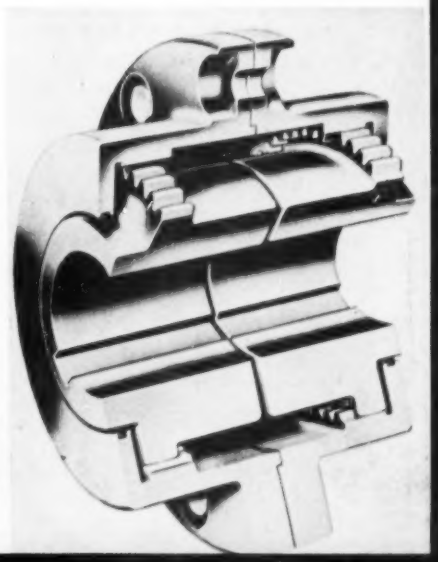
Gear Type Coupling

Two sets of internal and external spur gearings are involved in this type of coupling. Teeth of the external elements are cut on the two hubs which are pressed and keyed to each shaft. The internal teeth are cut in the surfaces of two companion floating sleeves. In operation, they mesh permanently around the entire circumference with the gear teeth on each hub. By virtue of design and existing clearance between ends of the sleeves and the hubs, the shafts are subject to free adjustment. Yet the shafts and sleeves revolve as one unit, the enmeshed gears compensating for any lateral or angular play.

Another design employs internal teeth at each end of a floating sleeve which mesh with corresponding sets of external spur teeth cut on the end of each shaft hub. Spherical formaion of the teeth of these latter enables free rocking action according to shaft misalignment requirements. These gears are permanently in mesh around the entire circumference, giving the maximum of load-carrying capacity.

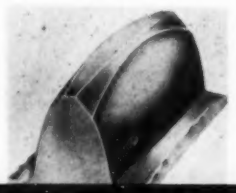
The method of sealing couplings of this latter type against entry of contaminents is of distant interest. A highly resilient oil-resisting packing ring seal is inserted in a tapered groove between the end plate and hub at each end of the coupling. It is claimed that such a seal does not impair flexibility; at the same time it aids retention of oil and exclusion of foreign matter. As a result, carrying high oil level should not lead to leakage.

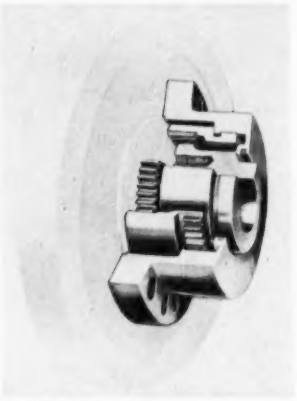
Lubrication Requirements—Since constantly enmeshed gear teeth are involved, positive lubrication is a most important factor. It may even be stated that the design of such couplings has been predicated upon effective lubrication. Normally this is brought about by merely charging the coupling to a predetermined level with a suitable grade of oil or grease in accordance with the prevailing service. Usually relubrication once every six months will suffice.



Sectional view of coupling assembled and view showing the tooth form and crowning which permits angular and parallel misalignments totaling around 7 degrees.

Photo courtesy of American Flexible Coupling Company.





Cutaway of a Farrel Manger coupling bolted to a flywheel. External gear teeth on hub in center mesh with internal teeth of the compensating member. External teeth of compensating member mesh with internal teeth in flanged outer sleeve. Flexible oil-resistant packing in outer sleeve bears on center hub to retain oil in coupling.

Photo courtesy of Farrel-Birmingham Company.

In operation of an oil-lubricated coupling, continued maintenance of an adequate oil film between gear teeth is brought about by pumping action between the load-carrying surfaces along with centrifugal force and capillary action. The speed of rotation will affect the pressure involved due to its relation to centrifugal force. With variation of alignment, this pumping action forces a renewed supply of oil to the load-carrying surfaces twice during each revolution. Positive lubrication is assured, provided a sufficient amount of oil is maintained in the coupling.

TYPE OF OIL—Oil viscosity for use in a gear-type coupling designed for oil will be governed by operating conditions. The normal range will be from approximately 100 to 1000 SSU at 210°F. In other words, you would use a product ranging in body from that of an extra heavy motor oil to a heavy gear lubricant. It will all depend upon coupling size and the operating temperature.

In northern climates, cold weather service would require an oil within the lower viscosity range or even one lower than 100 SSU at 210°F, whereas in tropical operations a heavy gear lubricant would be necessary in view of the viscosity-reducing effects of high temperatures.

GREASE LUBRICATION—In contrast with the above, other types of gear couplings are intended for grease lubrication. The basic idea is the same—to insure continuous maintenance of a lubricant film on the gear teeth to prevent wear. Means of application and renewal however, differ. Oil-lubricated couplings are filled or refilled from an oilhole in the housing which can be plugged during operation to prevent throw-out of oil. With a grease-lubricated coupling, there is provision for application by a pressure gun when the coupling is in service. During assembly, grease is often smeared on the gear teeth to insure a good initial coating when it goes into operation.

Choice of the most suitable type of grease becomes a problem when high speed or low temperature operation is required. For high speeds, the potential effect of centrifugal force must be considered—the possibility of soap being separated mechanically from the oil content.

A properly compounded sodium soap grease containing a highly refined mineral oil of from 90 to 150 SSU viscosity at 210°F has been found to effectually resist soap migration under very high speed conditions in laboratory tests run for periods up to 8 hours. Continued research is going on to determine what the maximum limits might be for speed, temperature, and time.

Conversely, at low speeds there may be some question at times as to the ability of the relatively low centrifugal force to effectually distribute grease over all the tooth surfaces. For this reason, the relative adhesiveness of any prospective grease must be studied.

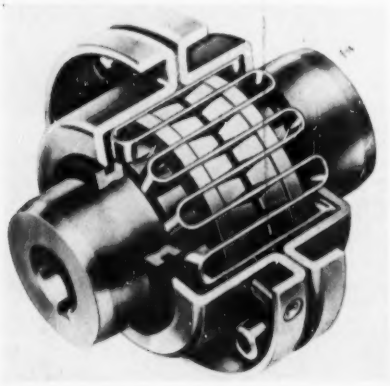
Steel Grid or Spring Type

Couplings of this type derive flexibility from the action of forged alloy steel grids on curved toothed steel hubs. The gridmember is inserted in the curved slots of the two opposing hubs. The grid fits snugly in the grooves with sufficient clearance to provide for a rocking and sliding action to accommodate parallel and angular shaft misalignment and end float.

Cross-section of the grid and radius of the slot is designed to maintain a constant stress on the grid as it bends and wraps around the tooth as required to smooth out variations of torque load. The torsional cushion thus

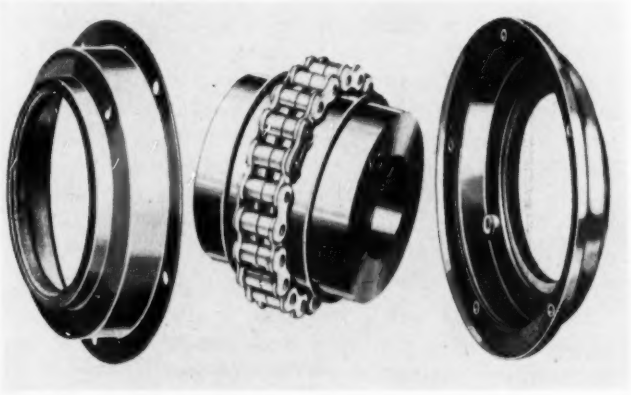
Cutaway of a Falk Steelflex coupling showing neoprene seal and lubrication fitting.

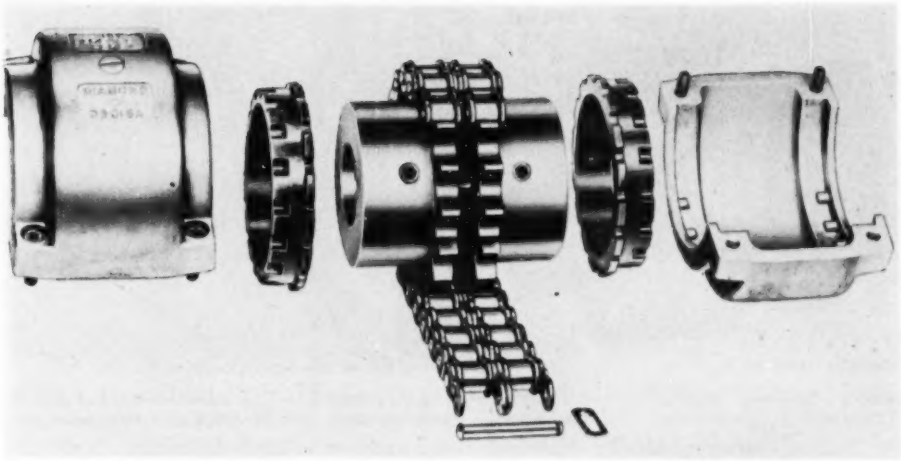
Photo courtesy of The Falk Corporation.



Link-Belt "RC" roller chain flexible shaft coupling with casings removed. This type of divided roller combines the construction of a single width chain with the advantages of a double width chain by providing independent roller contact with each coupling half.

Photo courtesy of Link-Belt Company.





Details of a Diamond flexible shaft coupling with type "A" casing. Casing protects lubrication by the pliable seal at each hub end.

Photo courtesy of Diamond Chain Company, Inc.

Morse flexible silent chain coupling, showing from left to right the cover half, sprocket, silent chain, sprocket and cover half with felt seal.

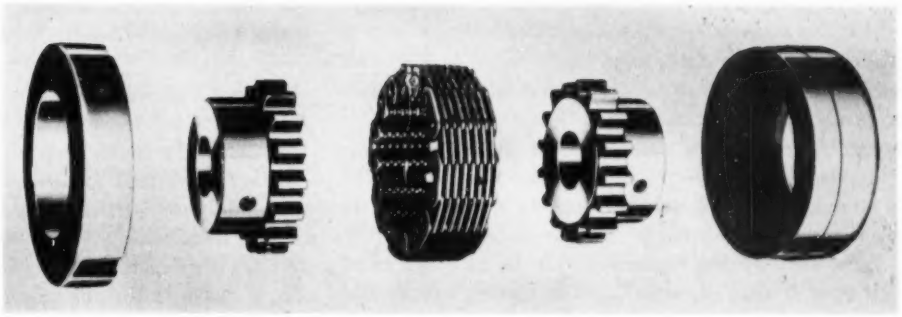


Photo courtesy of Morse Chain Company.

provided minimizes adverse effects of shock and vibration on the alignment of the connected machines.

GREASE LUBRICATION PREVAILS—Grease lubrication is essential to free action of the parts in steel grid couplings. This lubricant is contained by a two-piece steel cover with a gasket between the halves and neoprene seals at the hubs. When assembling the coupling, grease is packed into the spaces between and around the grids. For proper lubrication, the coupling should be completely packed with lubricant so that air pockets will be eliminated and a reservoir of grease provided in the space between the hubs. Centrifugal action on the grease will fill any small air pockets which may remain around the gridmember after assembly.

In operation, a grid or spring-type coupling should be lubricated at least once every six months by means of a pressure gun. In relubricating, the coupling should be vented by prying up the ring seal with a nail or small screw driver. The neoprene seals and tan fibre gasket prevent loss of lubricant and entrance of foreign matter.

Greases of the "all-purpose" or "multi-purpose" types recommended for general industrial use in ball and roller bearings have proven entirely satisfactory in grid-type couplings. Action of the grid-groove design is such that heat developed under misalignment is insufficient to adversely affect the stability of these greases and only ambient temperatures need be considered.

Flexible Chain Couplings

Chain-type flexible couplings may involve roller or so-called silent chains. The roller type are built with single rollers, divided or double rows of chain rollers. These mesh with sprocket teeth cut on the companion hubs to compose the flexible part of the coupling. This flexibility is developed by freedom of motion (laterally) by the sprocket teeth with respect to the chain; or in another type of chain coupling by the use of chain pins which can bend according to the extent of misalignment. All the while either type of chain connection maintains a snug fit around the sprocket teeth.

Silent link-type chains are similarly meshed with sprocket teeth on the hubs, but in this type of design the teeth are somewhat wider than where a roller chain is used.

LUBRICATION—Grease is the preferred lubricant for a chain-type flexible coupling. To accommodate this and to prevent leakage, the chain and hub assemblies are covered by two halves of a split casing which are securely fastened together. Steel washers and cork, neoprene or fabric sealing material, are used to prevent grease leakage between casing halves. Pliable shaft sealing at the hub ends permits end float of the respective shafts according to temperature and operating conditions.

Couplings of this type usually are filled with a high quality No. 1 grade grease at the time of assembly. In

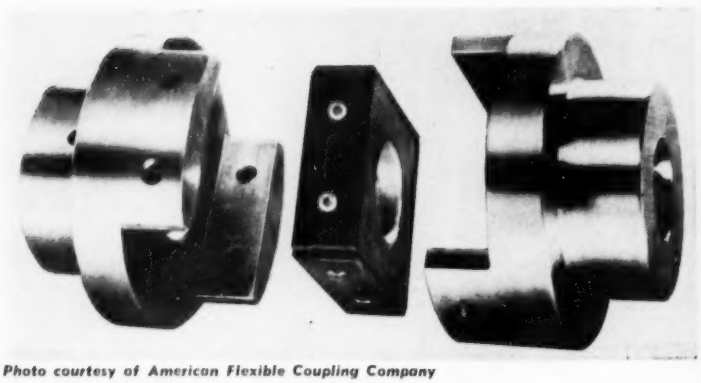


Photo courtesy of American Flexible Coupling Company

An "Oldham" typeflexible coupling. This type coupling does not require removal of flange bolts for disassembly.

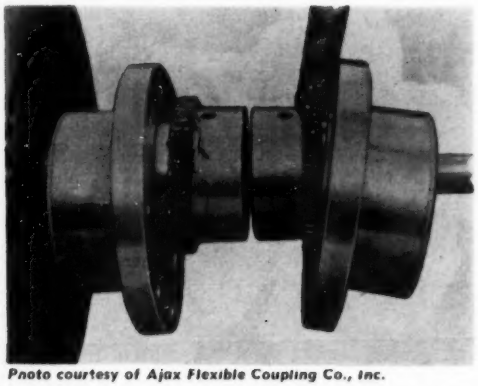


Photo courtesy of Ajax Flexible Coupling Co., Inc.

Grease lubrication being applied to an Ajax Dihedral coupling at the time of mounting. Additional grease may be added later by pressure gun.

service, they should be refilled at regular intervals of perhaps every two or three months. The manufacturers advise *never overfilling*, otherwise leakage may occur.

Floating Member Couplings

Couplings of this type derive flexibility from their mechanical structure. A typical design involves a non-flexible floating center member which slides between opposing parallel jaws on the exterior parts of the assembly. It is possible to add bearing strips to each side of the center member as an aid to lubrication.

These strips, being replaceable, can be of softer metal than steel if desired, although this feature will depend upon the extent of load as developed by misalignment. In another type, the center member is composed of a special laminated phenolic material which does not require lubrication. A floating member coupling allows for free end movement (axially) of either or both of the shafts, and at the same time it takes care of either parallel or angular misalignment.

LUBRICATION—The floating center member is lubricated along its contact sides with the jaws of the end flanges by oil or grease. A self-contained oil reservoir is incorporated in one design.

In the grease-lubricated type of coupling, the floating member has a hollow center which the manufacturers recommend should be filled half-full with a high grade medium-consistency grease in the N.L.G.I. No. 2 range. In both the oil or grease-lubricated coupling, lubricant can be renewed through holes in the flanges or via a pressure gun fitting.

Installation

Initial alignment is a very important item both with regard to the life of a coupling as well as the performance of its lubricant. A flexible coupling is not intended to function as a universal joint and it should not be used as such. In other words, there are limitations as to the amount of initial misalignment which should be tolerated both from a parallel as well as an angular point of view.

Initial misalignment must be as low as possible or there will be excessive motion between the coupling elements. In some gear-type devices for example, this could lead to so much movement between the teeth as to cause generation of considrable heat. In case of inadequate lubrication, ultimate breakage of relatively dry teeth could result.

Vertical Couplings

When a lubricated-type of flexible coupling is to be installed in vertical position, special provision must be made for complete circulation of lubricant. In gear-type couplings designed for oil lubrication, a center diaphragm can be installed between the hubs. A hardened steel button on this diaphragm bears on a hardened steel disc inserted in the upper end of the hub on the lower vertical shaft.

The diaphragm thus serves as the bottom of an oil reservoir for the top half of the coupling. In other words, each half is lubricated separately by the oil with which the respective reservoirs are filled.

Continuously Lubricated Couplings

Lubrication of couplings such as the gear-type also can be accomplished by oil circulation or what is termed con-

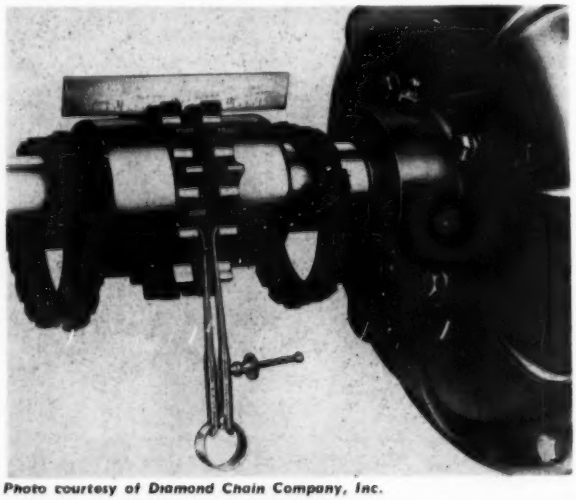


Photo courtesy of Diamond Chain Company, Inc.

Method of checking angular alignment of a Diamond flexible shaft coupling by measuring the space between spocket faces with calipers or feeler gauge.

tinuous lubrication. This method of lubrication is particularly applicable where the coupling can be completely enclosed in a housing. Hook-up to a circulating system can be made through a suitable oil inlet pipe as illustrated. Discharge from the coupling drains into the housing for filtration (if necessary) and recirculation. Complete submergence of the coupling parts in oil is beneficial both in the interest of lubrication as well as cooling. The prevailing flushing action also insures removal of moisture or solid contaminants.

Low Temperature Service

With the increased usage of low-temperature machinery and the necessity for power-driven units such as blowers, etc., to function under fairly continuous low temperatures, lubrication of flexible coupling elements under these conditions has become a research problem.

Conventional greases or oils are suited to the normal range of temperatures which may include zero to 200°F, but when it is desired to locate a coupling in an atmosphere as low as —100°F thinking must be revised as to the most dependable lubricant. Adequate film strength is important at normal to high temperatures, but becomes entirely subordinated to shear resistance at very low temperatures, but becomes entirely subordinated to shear resistance at very low temperatures, especially on starting.

Recent study of pumpability characteristics of greases at low temperatures has developed some interesting indications as to the relation of shear resistance to penetration. In practical operation they relate in turn to the workability of a grease. Laboratory studies made at —40°F have indicated that greases which show satisfactory working at this range would probably function successfully at even lower temperatures because the heat generated during operation should soften the grease sufficiently to enable it to provide adequate feeding and lubrication.

Inspection for Leakage or Wear

Leakage of either grease or oil from any type of lubricated flexible coupling is objectionable. It can increase the cost of lubrication and result in a sloppy hazardous condition around the machine.

It is equally important to seal the coupling against entry of abrasive foreign matter. Abrasive materials in a coupling can materially impair the protective ability of the lubricating film. This can result in wear of the coupling parts to such an extent as to prevent the coupling from functioning properly. Actual leakage may result in case of severe wear.

For this reason, periodic inspection is recommended. At the time of such an inspection, the condition of the lubricant can be noted, abnormal misalignment between the connected machines can be corrected and the coupling flushed if necessary. For this purpose, a fairly light flushing oil is helpful. Heating is beneficial in enabling a flushing oil to remove oxidized lubricant or accumulations of gritty sludge.

Summary

The several types of lubricated flexible couplings in use today, along with the wide range of service to which they are applied, present conditions which are not entirely conducive to specific lubrication recommendations. Lubrication is a phase of maintenance and as such it must be considered along with the maintenance requirements of the machinery to which the coupling is attached.

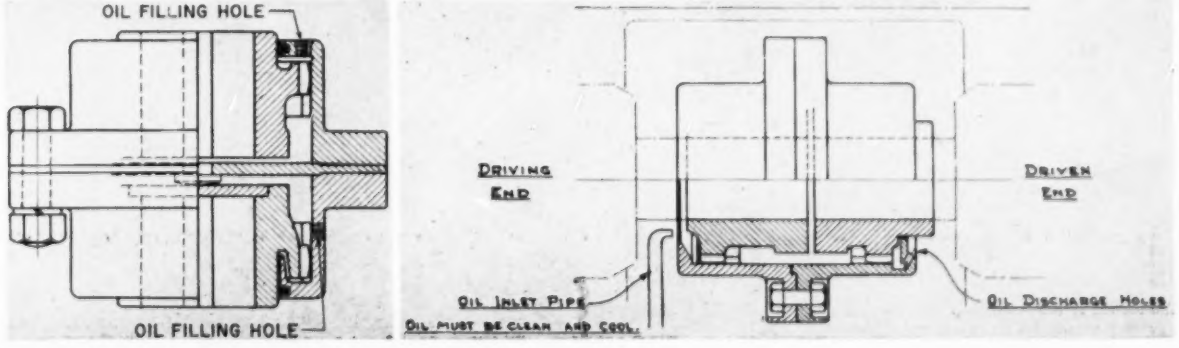
In other words, if lubrication of coupling and machine can be timed and attended to concurrently, the operator is more apt to do a conscientious job on both. This, of course, brings the coupling builder into the picture and involves his methods of sealing and means for relubrication. His recommendations should be adhered to as closely as other considerations will allow.

Then there is the question of type of lubricant. Coupling builders have combined their field experience with their knowledge of lubrication to good advantage and their ideas as to this phase of maintenance are of much value to operators.

Lately, there has been additional thinking as to the benefits of additive type lubricants where conditions of severe load or relatively high temperatures are involved. The advantage of a certain amount of "Extreme Pressure" ability in the lubricant is accepted. Typical of this type of product are the mild "E.P." non-corrosive lead naphthenate lubricants which are so widely used today for the protection of industrial gears.

At left, vertical adaption of a Poole flexible coupling showing the method of installing diaphram and button to obtain upper and lower oil chambers. At right, a sectionalized view of the continuously lubricated type. Another example is seen in the DeLaval spacer-type coupling illustrated.

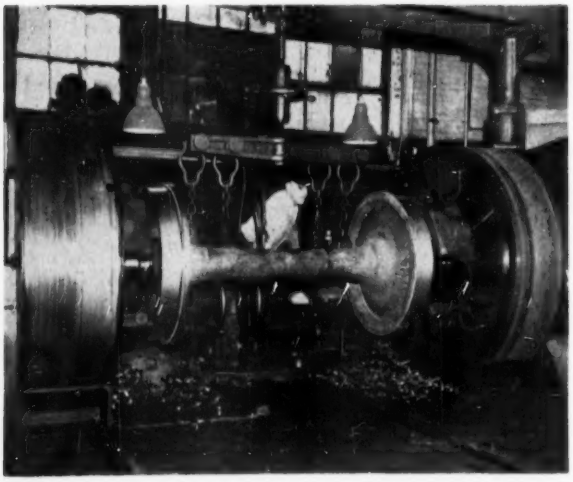
Photo Courtesy of Poole Foundry and Machine Company.



Number 1000 was the first diesel electric locomotive purchased by the Jersey Central and is still in serviceable condition. It was installed in service in October 1925 at the Bronx Terminal in New York.

More Diesels for the JCL

Dieselization of the Jersey Central Lines began in 1925 and is now nearing completion. Their current improvement program calls for the addition of 93 diesel-electric locomotive units and four diesel tugboats.



One section of the wheel shop at Elizabethport houses wheel lathes. Here, axle and wheels are chucked and both wheels turned simultaneously.

IN October, 1925 the Jersey Central placed locomotive No. 1000 in operation. This unit was the first American-built diesel-electric locomotive to be placed in service in the United States, and is still in serviceable condition. No. 1000 was a product of the American Locomotive, General Electric, and Ingersoll-Rand Companies. It is rated at 300 hp and develops 23,000 lb of tractive effort.

Now, the JCL has 175 diesel-electric locomotive units in daily operation over its 633-mi system. Road freight service is 100 per cent diselized, while passenger and yard switching service are respectively 85 per cent and 75 per cent dieselized.

Of some 80 serviceable steam locomotives being temporarily retained by the road, only seven are used in passenger service and about 35 in yard switching service. Others are being held in reserve and will gradually be replaced with diesel units. Passenger trains still hauled by steam power are operated on various short runs such as the 17-mi stretch between Jersey City and Cranford.

Represented in the Jersey Central's equipment register are Alco-GE, B-L-H, EMD, and F-M units of various sizes. Following is a breakdown of diesel-electric locomotive units by horsepower:

Units	1	1	12	6	21	22	57	49	6
Hp	275	300	600	660	1000	1200	1500	1600	2000

Diesel Repair and Servicing Facilities

As on other railroads which have been progressing toward full dieselization, maintenance facilities on the JCL have undergone a revolution. Four shop points, the Elizabethport Locomotive shop in Elizabeth, N. J., and engine terminals at Communipaw (Jersey City), Bethlehem, Pa.,

and Ashley, Pa., perform all locomotive repairs for the system.

Complete locomotive overhauls are handled at the Elizabethport shop. Here, engines, generators, trucks, traction motors, and other component assemblies of the locomotive are dismantled, thoroughly inspected, and rebuilt with either reworked or new parts. Electrical power and control equipment contractors, relays and switches are checked and repaired or renewed as necessary. Where required, overhauled assemblies are bench- or rack-tested prior to reinstallation on the locomotive.

Axles, crankshafts, connecting rods, and other engine and locomotive parts are magna-flux tested for hidden flaws or cracks. When reassembled, the locomotive is tested under load to insure ultimate performance, painted, and returned to service.

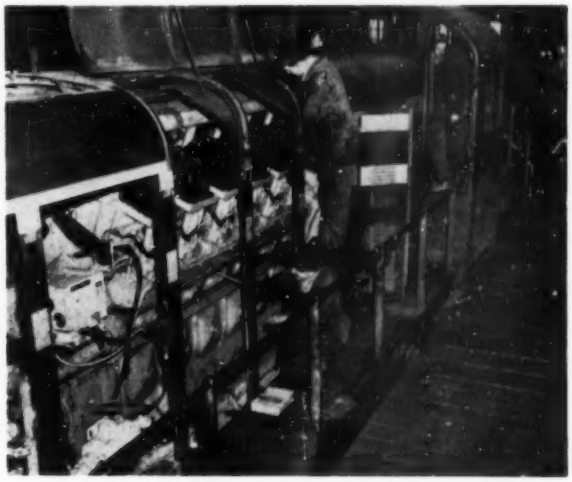
testing engines under load, toolroom, wheelshop, and electrical shop.

In the toolroom, tire-turning tools are machined and ground, various gauges are constructed and kept in tip-top shape, and special work requiring care and accuracy is performed.

In the wheelshop all diesel locomotive wheel and axle work is performed. Machines for pressing wheels off and on axles and for necessary machine work such as boring wheels, turning axles, finishing and rolling journals, are installed in this section of the shop. An electrical equipment and storage battery shop at Elizabethport handles servicing and repairs to storage batteries for all diesel locomotives.

Communipaw Engine Terminal, once one of the largest and most modern steam locomotive terminals in the coun-

View of the Elizabethport shop with assorted makes and types of diesel-electric locomotives in various stages of repair.



Preventive maintenance is a continuous job on the Jersey Central Lines. Here, maintenance men adjust a diesel locomotive unit.

Facilities for performing this work were provided by the modification of a large steam locomotive heavy repair shop at Elizabethport. At the east end of the shop, a 100-ton Whiting drop table, extending the entire width of the shop, servicing three tracks with a fourth track in the reclamation area, was installed to facilitate truck removal.

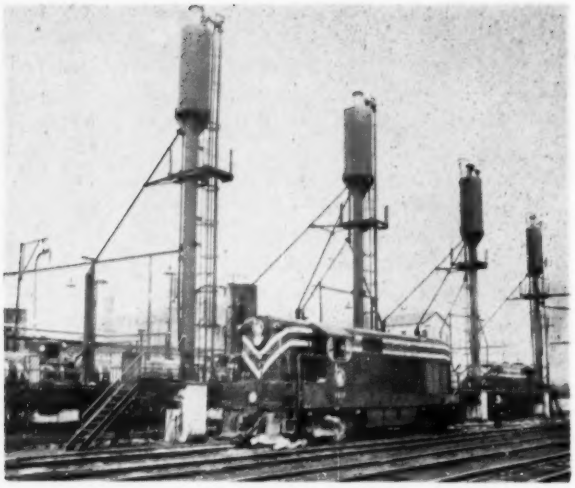
Elevated platforms were installed between tracks at engineroom floor height. In addition to this, floor levels between pits were depressed. Thus, three convenient working levels have been provided. The parts repair and reclamation area is located in a bay adjacent to the main repair area, and reclamation is performed only on parts where it has been found economical to do so. Further improvements of these diesel repair facilities are being made as requirements and research dictate.

Other facilities include engine overhaul, filter cleaning and parts cleaning rooms, a water-box type load tester for

try, is now equipped with facilities for complete servicing of diesel and steam locomotives. A modern diesel servicing plant was installed on the south side of this terminal in 1947. This plant has a fuel oil storage capacity of 100,000 gallons (soon to be doubled), 20,000 gallons of lubricating oil, and 50 tons of sand. An average of 159 locomotives are dispatched from Communipaw every 24 hours, including locomotives of the Reading Company and Baltimore & Ohio Railroad, both of which run passenger trains into this Jersey City terminal.

Bethlehem Engine Terminal services and repairs all diesels operating on the Pennsylvania Division including all freight, passenger and switching units. Also, any running repairs that may be required on road freight units operating in and out of this terminal are performed before dispatchment.

At Ashley Engine Terminal, monthly inspections and



Several points on the Jersey Central are equipped with servicing facilities at which fuel, lube oil, water and sand are supplied to diesel units.

repairs are performed on all yard and road switching units assigned to that territory. A servicing station was also installed at this location to handle all road and switching locomotives operating in this territory. Additional servicing facilities are at Elizabethport, Phillipsburg, Mauch Chunk, and Penobscot.

Utilization of Diesel Locomotives

The considerable investment in diesel locomotives, which includes $14 million spent in the last three years for 93 units of this type of motive power and additional expenditures during the last several years for shop modification and servicing facilities on the Jersey Central, make it quite necessary that the road's 175 locomotive units be assigned and used in such a way that advantage is taken of the diesel's high availability. Most diesel locomotives are quite versatile which makes it easier to assign them to some combination of runs or services so as to keep them in service a greater percentage of the time.

On "The Big Little Railroad," as the JCL is called, this is a much more difficult job than on larger systems with lines between a number of distant cities where runs are longer. JCL Jersey City terminal receives 100 or more passenger trains every 24 hours and dispatches about an equal number. However, some 75 to 80 are commuter trains between North Jersey suburban communities and Jersey City.

Commuter trains leave numerous points of origin, beginning early in the morning and arriving in Jersey City mostly between 6:30 am and 9:30 am. In the evening a similar group of trains departs from about 4:00 pm to 7:00 pm. Power to protect these trains must be at outlying points in the morning and at Jersey City for evening departures, and there is little if any opportunity to get any service out of them at night or during layover time at Jersey City.

However, other local passenger trains start early in the morning and operate to several points, from which the locomotive is dispatched on industrial switching jobs then returns to Jersey City in passenger service, in time to protect commuter trains leaving that point in late afternoon.

In road freight service, locomotives are assigned to scheduled trains so that there is a minimum of layover time at terminals. For example, a locomotive starts out of Jersey City with a tonnage train for Scranton, a distance of 192.8 miles, where after a layover of perhaps two hours, it is assigned to a train for Allentown a distance of 102.5 miles.

Approximately two hours after arrival at Allentown, the locomotive is on an assigned train, Allentown to Jersey City. About two hours after reaching Jersey City it is on its way back from Jersey City with another train for Scranton, and so on day after day.

New Diesel Tugboats

Within recent months, the Jersey Central has received four new diesel-powered tugboats. Each of the new tugs has a 1600-hp diesel engine enabling it to reduce materially the time consumed in "delivering the goods" in and around the harbor.

One of these diesel tugboats can tow two of the largest carfloats from Jersey City to Long Island City—a six-mile run around the Battery and up East River—in 45 minutes, compared with the former time of nearly two hours. Other moves are made with an equally impressive saving in time.

Speed alone, however, is not the sole advantage offered by new tugs. Here are some others:

Engine control direct from pilothouse eliminates engine room signals. This gives the captain quicker and surer control over his tug and tow. He can reverse engine power to the propeller of his 110-ft tug from full speed ahead to full speed astern in six to seven seconds.

These new tugs carry 35,000 gal of fuel oil and enough lube oil for 40 days service. They can be bunkered in less than 30 minutes.

Complete auxiliary equipment includes two 40-kw diesel engine generator sets and a 500-gpm electric fire pump.

These new tugs, through their greater speed and availability, increase the utilization of the railroad's fleet of 42 covered barges (14 of which are especially equipped for carrying bulk cement), its 23 open-deck lighters, 13 steam-hoist lighters, and 13 carfloats.

Conclusion

This railroad like most others in the United States has not been slow to recognize the advantages of diesel over steam power and to adopt it and put into use as fast as opportunity presented. Utilization is a problem which likely will be with them for a long time, but recent conversation with some of their personnel indicates that they are keenly aware of this potential economy and are studying it constantly and making such changes in locomotive assignment as seems possible. No doubt improvement will be made in this operational problem with the addition of more diesel-electric units, providing higher locomotive availiability.

Improperly Cleaned

Properly Cleaned

Clean Spray Tips Properly!

ORIFICE design is important if an injection nozzle is to function properly. Sizing is only one consideration. The length/diameter ratio is also important in order to get the proper discharge characteristics, atomization, and penetration of the spray in the highly compressed air within the cylinder. Angle of these orifices is also a matter for consideration since the spray must be directed into the chamber cavity provided, and not allowed to impinge on the cylinder head, liner, or piston crown.

In effect, the orifices are tubular passages that must discharge a given quantity of fuel with certain pressure-velocity relationships. If you were to check any of the standard texts showing the effect on hydraulic flow due to the variation of the orifice shape, sharpness of edges, etc., you would see immediately the effect of oversizes, ragged edges, bell-mouthing, etc.

Now you have the picture as to why it is extremely important to retain the original shape and size of the orifices in the spray tip as long as possible. You can't help a certain amount of normal wear and erosion that will take place over a long period of time, but you can retard the eventual time of replacement by careful observance of the proper cleaning procedure.

This is the "why" of good spray tip maintenance; now the "how" will be covered. These are the recommendations of Bendix-Scintilla, but the principles have wide application.

Two main things are desired: exterior deposits such as craters, flags, etc., must be removed; and deposits within the orifices must be cleaned out. Included in the first objective is the maintenance of the original high polish on the spray tip surface, particularly on the nose. The reason for this lies in the fact that it is harder for carbon to form on polished surfaces than on rougher finishes.

Anyone who has tried to remove hard carbon from an orifice by means of a fine-gauge piano wire will appreciate the difficulty and the frequency with which the wire breaks and jams in the holes, necessitating tip replacement. Solvents and softeners are the answer.

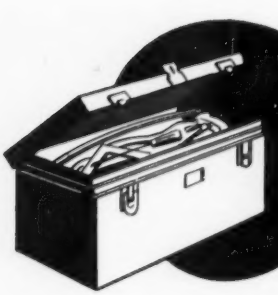
Bendix recommends boiling the spray tip in a cleaning solution. Their particular procedure is to prepare a solution of cleaning compound and water, place in any suitable clean container, and heat to the boiling point. Boiling is continued for about 10 minutes. Following this, the tip is wiped dry with a clean cloth and compressed air is used to blow out the spray tip from the orifice end.

Chemical companies, specializing in cleaning compounds, will be able to suggest a suitable compound. It must be borne in mind that it must be able to soften the carbon deposits without harm to the base metal. The particular material used by Bendix is produced by the Finger Lakes Chemical Company, Etna, New York, and designated "Lake-seal TU-2 Cleaning Compound". Mixing proportion is 1 oz per gal of water.

The spray tip is then mounted in a collet or chuck, holding it by its small outside diameter, and rotated. Crocus cloth, dampened in oil, is used to polish the end and particularly the entire nose. The use of emery cloth or a wire brush is definitely not recommended as it has been found that these tend to cause "bell-mouthing" of the holes and roughening of the surface.

Orifices can then be cleaned by using the proper size wire in a pin vise. The diameter of the wire should always be at least 0.001 to 0.002-in less than the orifice size. It is important that burrs be removed from the end of the wire before using.

The fit of the wire in the orifices will give an indication of the degree of wear. The effect of wear will vary with the type and size of engine, but will always reduce combustion efficiency. It is Bendix's recommendation that spray tips be discarded when more than half of the orifice holes are oversize by 0.0004 in or more.



Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

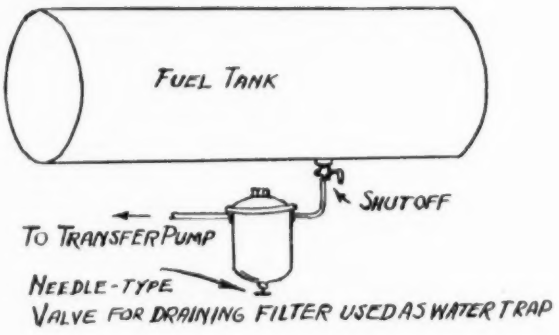
Trapping Water in the Fuel System

PAT MCGWIN, YELM, WASHINGTON—I have found that one of the greatest trouble makers for high-speed diesels as used in tractor or portable power plants is water in the fuel. The source is frequently condensation in the fuel tanks, particularly on machines using fuel oil for transmitting power in torque converters. Return of the heated oil to the tank seems to promote condensation.

An operational way of reducing condensation in the tanks is to fill the tank to capacity at the end of each shift. Drain the primary filters each morning or before the start of the next shift. This practice will materially decrease trouble from this source.

On machines not having tank water traps, I have found a simple remedy to be the incorporation of a filter in the fuel line as near the tank as possible. Both inlet and outlet of the filter should be below the level of the bottom of the tank. This overcomes the danger of admitting air while draining any water that may accumulate. I prefer to use a needle-type valve at the drain. It gives a more airtight seal and will not jiggle loose as sometimes happens with petcocks.

Caterpillar has a very good filter system, but it is on the engine itself. If the water trap is drained (it's just a plug in the filter housing), it takes some time to bleed out the system. Other rigs have traps of one kind or another in places where they are hard to get at and usually get attention only when trouble develops. In the case of trucks, the traps are usually above the level of the fuel in the tank. This makes a wonderful point of entry of air into the system during servicing and that "ain't good".



A water trap ahead of the fuel transfer pump can usually be bled by gravity and is more apt to be drained. If a filter is installed as suggested, it can be used without a filter element (simply as a water trap) if it is found that the transfer pump lacks capacity to handle the additional pressure drop of another filter.

Elimination of water from fuel is a creditable objective no matter how it is done. Since the chief sources of water in the fuel are introduction during handling or storage and through condensation, attack should start at the source. In the first case, improve the systems used. Degree of condensation is largely a matter of climatic conditions and a means of minimizing this is suggested. If condensate is troublesome, make bleeding easy and it will be done more often whether from a filter or a regular water trap—Editor

Emergency Penetrants

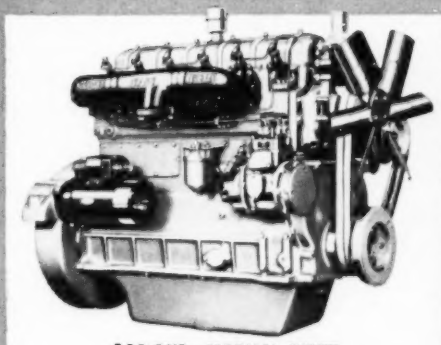
OLE CHRISTIANSEN, KINGSTON, N. Y.—Here is a trick that may or may not be generally known. Don't laugh because it really works fine. In my work with the Adirondack Transit Lines, I have been sent out to repair a bus or other equipment and have run into rusted or stubborn nuts to be loosened. Usually that is when the "Liquid-Wrench" or "Kan't-Rust" is back in the shop. Don't worry, just get yourself a bottle of coke or Pepsicola. Pour it on that tight nut and let it stand a few minutes. You will wind them right off. Sloan's Liniment works too, but may not be as handy as the others.

Don't know much about these beverages; we're a Scotch man. We have heard they make a pretty good soldering flux (fellow in the office swears by it), but this is a new one on us. We'll take Mr. Christiansen's word for it and try it out first chance that we get—Editor

WAUKESHA

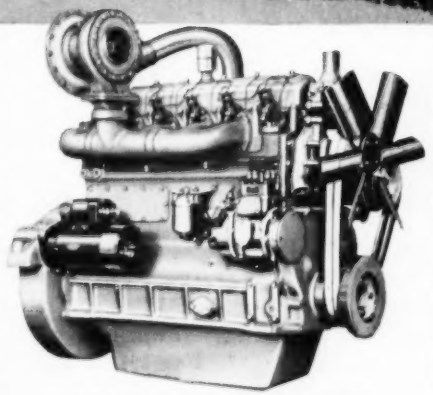
PAYLOAD POWER PLANT

Diesel - 135 Series - *Gasoline*



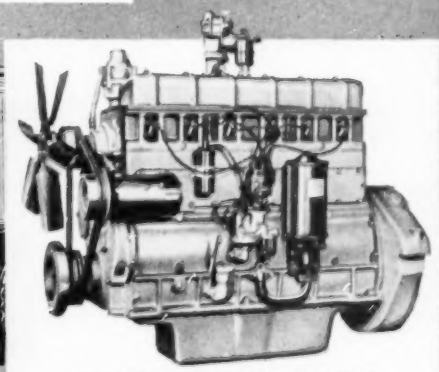
135-DKB—NORMAL DIESEL
426 cu. in. Max. hp 147 @ 2800 rpm.

FAST
SMOOTH
POWERFUL



135-DKBS—TURBOCHARGED DIESEL
426 cu. in. Max. hp 185 @ 2800 rpm.

SEND FOR BULLETINS

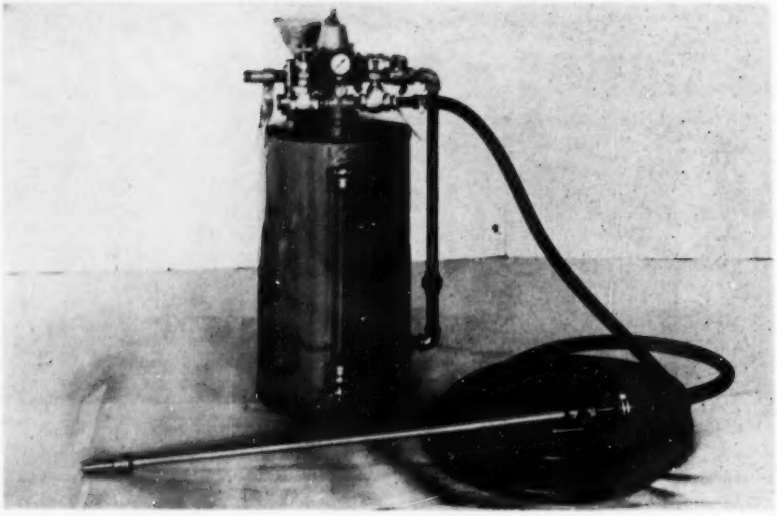


135-GKB and 135-GZB—GASOLINE
426 and 451 cu. in. Max. hp 147 and 153 @ 2800 rpm.

214

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS. • NEW YORK • TULSA • LOS ANGELES

PRODUCT



Foam Generating Unit

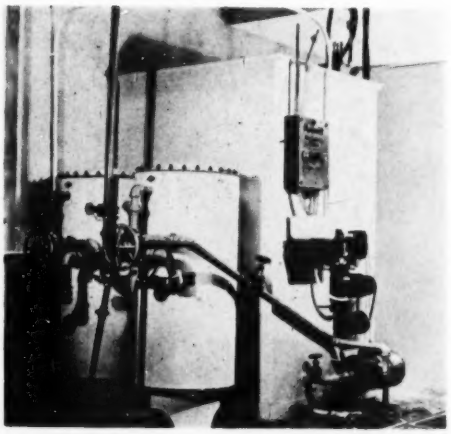
Oakite has developed a foam-generating unit designed to permit faster, more economical exterior washing of diesel locomotive power units. Detergent-foam spray clings to vertical surfaces, penetrating and loosening dirt films so that follow-up fountain brush rinsing readily flushes away the softened soil.

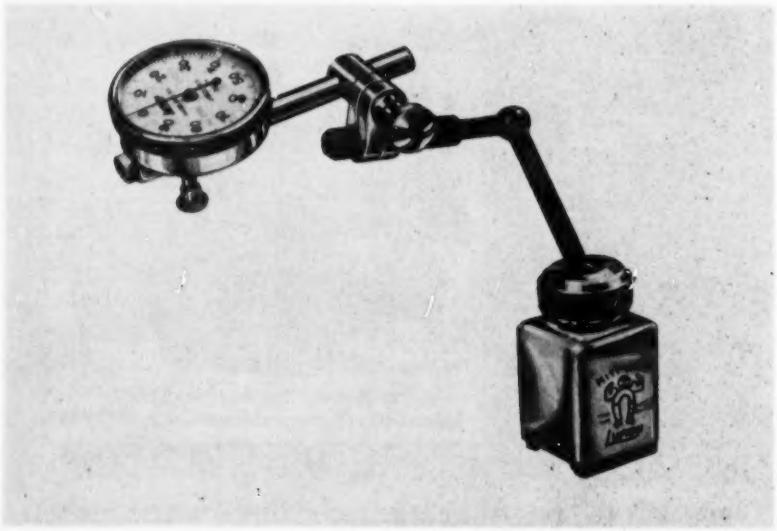
Compared to ordinary manual cleaning methods of scrubbing diesel power units, the foam-spray method is designed to cut cleaning solution needs by as much as 50 per cent by eliminating run-off.

Package Water Conditioners

A package water conditioning plant designed for efficiency and simplicity has been developed by the Permutit Company, adding another unit to the company's line of ion-exchange resins and water conditioning apparatus. These units, without any alterations, may be used to remove turbidity, color and organic matter from water supplies; chlorinate; remove bad tastes and odors; remove iron and manganese; neutralize; soften and de-alkalize.

The plant, as a complete package, forms a versatile and self-contained unit which is available in eight standard sizes ranging from 500 to 3300 gph and flows of 12,000 to 79,200 gal per 24-hr period. Units with larger capacities can be furnished on request. Further details are available upon request, from the Permutit Comany, 330 West 42nd St., New York 36, N. Y.





"Miti-Mite"

Lufkin has recently introduced the "Miti-Mite", a magnetic-base indicator holder. It is designed to eliminate cumbersome, time-consuming clamping and provide greater accuracy when indicating work.

A permanent magnet in the base provides a 50-lb pull and may be attached to any round or flat, iron or steel, surface, according to the manufacturer. At present, three models are available.

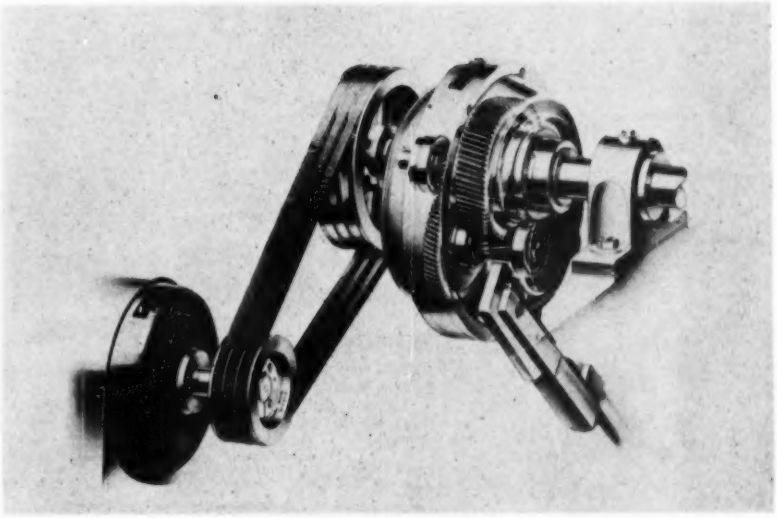
Model 100 and 101 have a 50-lb pull while the Model 150 provides a pull of 100 lb. Details are available from the Lufkin Rule Comany, Saginaw, Mich.

PREVIEW

Speed Reducer

A series of 13:1 ratio, shaft-mounted speed reduction units have been introduced by the American Pulley Company, 4200 Wissahicken Ave., Philadelphia, Pa. Called the "Shaft King", the units are adaptable to any shaft size up to 3 15/16 in and mount directly on the shaft of the driven machine.

Two trains of flame-hardened helical gears reduce the driven shaft speed to obtain a 13:1 ratio. Gearing and bearings are continuously splash-lubricated by the high-speed gear and the counter-shaft pinion which operate in an oil reservoir of the 3-wall housing.



Diesel Fork Lift Unit

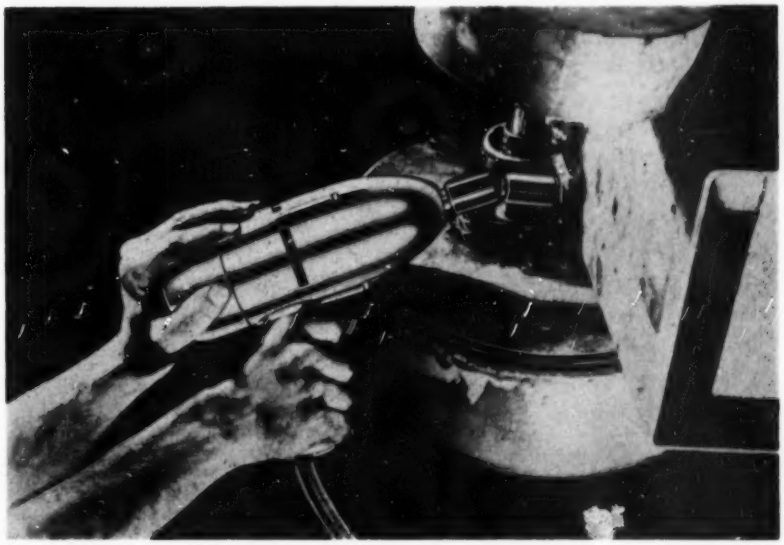
A 4-wheel drive "Forkloader" with five speeds forward and reverse, designed for heavy-duty operation on rough terrain, mud, snow and sand, has been introduced by the Baker-Lull Corporation. Power for the unit is supplied by a 6-cyl Hercules DJXC diesel rated at 77 hp. Bore and stroke for the engine 3¾ in by 4½ in respectively. Lifting capacity is 6000 lb and is obtained through a hydraulic circuit with 1200-psi working pressure.

The entire hydraulic system is pressurized by a gear-type hydraulic pump. Lift controls are located at the operator's right hand. Units are available with front, rear, or 4-wheel steering. Low-pressure, high-flotation tires prevent excessive sinking action when traversing soft terrain. Information on the 60N forkloader is available from Dept. KP, Baker-Raulang Company, 1250 West 80th St., Cleveland 2, Ohio.

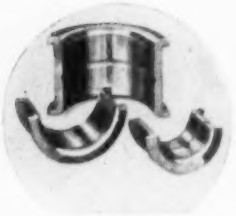
Impact Wrench

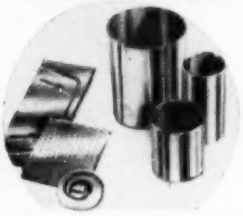
A ½-in electric impact wrench has been added to the Snap-On Tool Corporation's extensive line of tools. Available for use with the tool are a variety of sockets and other attachments such as screw driver bits, hole saws, steel, wool and masonry bits, and structural reamers.

Also, the impact wrench can be used for driving wheel pullers or gear pullers. Forward or reverse action, with or without the motor running, is obtained by twisting the end cap. Further information is available from Snap-On Tool Corp., Kenosha, Wisconsin.

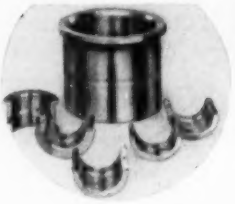


JOHNSON
Aluminum Alloy
Bearings
are light weight, heavy wall types, up to 14 inch diameters.





JOHNSON
Aluminum-On-Steel
Bearings
are the new type for high loads and high speeds.

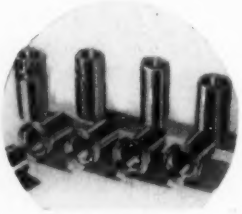


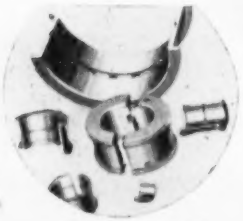
JOHNSON
Bronze-On-Steel
Bearings
for many thin wall applications.

●

JOHNSON
Babbitted Bearings
are made in steel back and bronze back types.

JOHNSON
Self-Lubricating
Ledaloyl Bearings,
molded powder metal, serve applications where heavy duty is not a factor.





JOHNSON
Cast Bronze
Bearings
are produced in all alloys up to 14 inch diameters, plain or graphited.

For Every Diesel Use

YOU can rely on Johnson Sleeve Bearings for outstanding service on all diesel applications . . . every type used.
Write for complete information

JB

JOHNSON BRONZE CO. 470 South Mill St., New Castle, Pa.

Heatless Galvanizing

"Formula #50", claimed as a new method of surface protection for iron and steel, has been developed by Constad Laboratories, 120 W. 23 St., New York 1, N. Y., offering on-the-job galvanizing. Applied with a paint brush or spray gun, the formula takes one hour to dry and leaves a deposit of .25 oz per sq ft with thicknesses of .005 in to .007 in. One gallon is said to cover 500 sq ft.

The product may be used over rusted surfaces (loose scale removed), a galvanic action taking place through the rust. According to the manufacturer, rust creep is prevented by electrical continuity produced between the steel and the coating. It may be used on any iron or steel surface or as a touch-up on previously galvanized surfaces. However, the company states that the formula is not a cure-all and that "where application is practical it will serve well." Reports of tests conducted are available.

Recovery of Chromic Acid

Of interest to platers is a new process developed by Barnstead Still & Sterilizer Co., 195 Lanesville Terr., Boston 31, Mass., whereby rinse water can be passed through ion-exchange resins to effect nearly 100 per cent chrome recovery.

In the process, the rinse water is first passed through a cation column to remove aluminum and copper, and then through an anion resin bed which removes the chromic acid. Acid is then recovered in the regeneration process. The same resins may be used for 100 or more cycles. In addition to elimination of the waste disposal problem, and savings in chromic acid, the user obtains a supply of demineralized water as a byproduct of the process.

Crane Truck Attachment

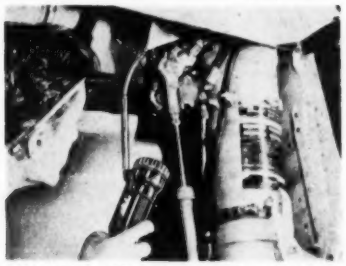
One or two men can safely work at otherwise inaccessible overhead jobs because of a new attachment on a crane truck introduced by Yale & Towne Mfg. Co., Yale Materials Handling Div., Philadelphia, Pa., it is announced. The Hydro Sky-Lift, as it is known, is basically a gigantic articulated arm which can lift 500 pounds from the floor and hold it at any point within the upper half of a sphere 26

ft in radius, measured from the pivot point of boom attachment.

From the truck which serves as its solid base, it can stretch to a height 34 ft from the ground and offer a stable platform in a horizontal circle. At the end of the boom are either one or two crows' nests, large enough for a man to work in comfortably. A set of controls is fitted in each crow's nest, hydraulically operated to insure positive action at any degree and direction.

Dual-Lighting Flashlight

U. S. Electric Mfg. Corp., 222 W. 14 St., New York 11, N. Y., is manufacturing a new industrial flashlight with built-in dual-lighting system providing a probe-light for pinpoint inspection of inaccessible parts and equipment.



The "Duo-Flex", as it is called, has both 1000-ft flashlight beam and flexible slide-out cable with bulb and plastic guard. When the side arm is extended, light is automatically transferred to the small bulb and the extension tube can be goosenecked around corners or into out-of-way spots. Extension of the arm measures 10½ in.

Oxycat Controls Air Pollution

Eugene J. Houdry, father of the Houdry catalytic cracking process so well known in the refining of gasoline, has developed a new oxidizing catalyst which is having a broad impact on general industry. By effectively lowering the temperatures at which combustible gases or fumes can be consumed, the catalyst permits the objectionable materials to be eliminated as a source of air pollution.

Several installations in various industries have demonstrated the ability of the catalyst to economically remove both smoke and odor from gaseous discharges. Of particular interest here is that the Oxycat cells have been in use for over two years in catalytic mufflers for the removal of carbon monoxide and hydrocarbon fumes from the ex-

Sound Engineering

by

BURGESS-MANNING COMPANY

. . . wherever the flow of AIR, STEAM, and other GASES create N-O-I-S-E.

Standard Snubber* designs are available, incorporating Air Cleaning, Spark Arresting, Water Separation, Waste Heat Recovery, and Surge Control Features.

You can depend upon Burgess-Manning Engineers for a quality product . . . and SOUND ENGINEERING counsel to solve your noise problems.

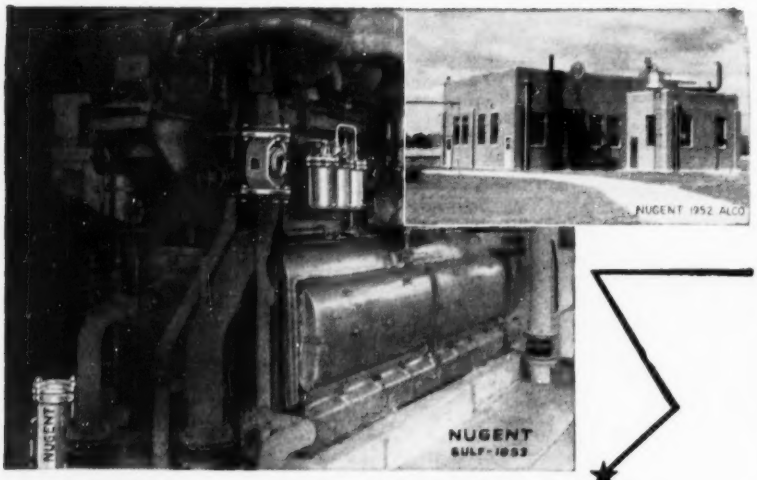
Burgess-Manning Snubbers installed at Corpus Christi, Texas, pumping station.

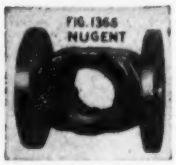
*Typical Snubber

BURGESS-MANNING COMPANY

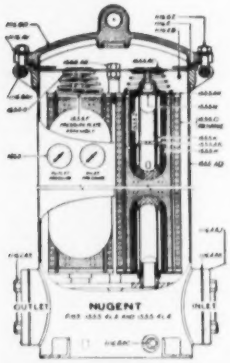
749-B East Park Avenue, LIBERTYVILLE, ILLINOIS

Chicago Dallas





Nugent Sight Flow Fitting. Shows flow of water to the jackets.



Size #4L4 Engine Lube Oil Filter.

Nugent Duplex Fuel Oil Filter.

NUGENT FILTERS
HANDLE THE COMPLETE JOB on this 1170 H.P. Pumping Station Diesel

LOCATED at Stateline Station, Union City, Ind., the 8 cylinder Alco diesel illustrated is a vital cog in the Gulf Oil Company's Tulsa-Lima Pipe Line. That's why the fuel oil and the entire lubrication system of this 1170 H.P., Turbo-charged engine is protected by Nugent filters and a Nugent Sight Flow indicator.

A Nugent #1R Duplex Fuel Oil filter on suction of fuel pump and Nugent #1R on discharge of fuel pump keeps the fuel oil clean for trouble-free injection — a Nugent #4L4 Engine Lube filter cleans all the engine lube oil in circulation every cycle before going to the bearings. A Nugent Sight Flow indicator provides a visual check on water flow to the jackets.

By actual test, Nugent filters remove particles as small as a few microns and prevent them getting to where they can accelerate wear and tear and shorten engine life. In addition Nugent Filters offer a choice of full flow or by-pass filtering with the same unit. Recharges are inexpensive and easy to install. Simple piping makes installation no problem.

Write for descriptive literature that shows how to insure the long life of your diesel.

Wm. W. Nugent & Co., Inc.
417 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

hausts of engines running on non-leaded gasoline. The effect is to convert them into harmless carbon dioxide.

Houdy is now working on catalytic mufflers for diesels and engines using leaded gasolines. When perfected for this application, it is predicted that the units would end a major source of metropolitan air pollution—the hydrocarbons exhausted by city buses an automobiles. This is only one of such possible applications.

Oxy-Catalyst, Inc., Wayne, Pa., of which Houdry is president, manufactures the catalytic units. They are cage-like structures comprised of porcelain rods coated with the catalyst—alumina and platinum alloy. By substantially lowering the temperature necessary for combustion, the hydrocarbons and carbon dioxide in hot exhaust gases are further consumed. Heat is gained in the process of further combustion. In the case of colder gases, heat is applied to bring them up to the minimum required for combustion. Since the minimum is greatly reduced by the Oxycat cells, the amount of heat required is far less than that necessary for ordinary incineration.

Water-Oil Separator

A redesigned Houdaille water-oil separator is being offered by the Honan-Crane Corp., 203 Indianapolis Ave., Lebanon, Ind. The new design is said to be especially effective in removal of moisture from vacuum pump oils, reducing downtime and increasing overall operating efficiency.

The unit features two filtering compartments using cellulose fiber and fullers earth filtering media, plus a thermostatically controlled heating and settling tank. Filter cartridges are interchangeable and replaceable. Heater unit may be connected to any convenient electrical outlet.

Poppet-Type Solenoid Valve

The Automatic Switch Co., Orange, N. J., has placed on the market a new 4-way packless poppet-type solenoid valve which is said to operate up to 750 cycles per min intermittent duty, and up to 500 cycles per min continuous duty, with air or gas as the medium. It will also operate on oil or water.

New Paint Strippers

Oakite Products, Inc., 19 Rector St., New York 6, N. Y., has developed two new paint strippers Nos. 56 and 57 designed respectively for tank immersion stripping and brush-on stripping of alkaline-resistant paints and lacquers.

Composition No. 56 is a thin-bodied solvent neutral in character and having a pH of 7. It is non-inflammable, used at full strength and unheated, with parts to be stripped immersed for varying periods of time depending on condition of paint to be removed. It is said to be safe on steel, brass, copper, zinc, magnesium and aluminum and also on wood.

Composition No. 57 is a viscous solvent for replacing combinations of non-viscous solvent detergents and thickeners when stripping finishes from vertical and inverted surfaces of equipment. It is non-inflammable and may be applied safely on all metals at full strength.

Breather for Engine Crankcases

A new breather for engine crankcases, gear boxes, fuel tanks, and similar applications, that increases dust filtration capacity and minimizes back

pressure by special design of the filter element has been developed by Crenlo, Inc., Rochester, Minn.

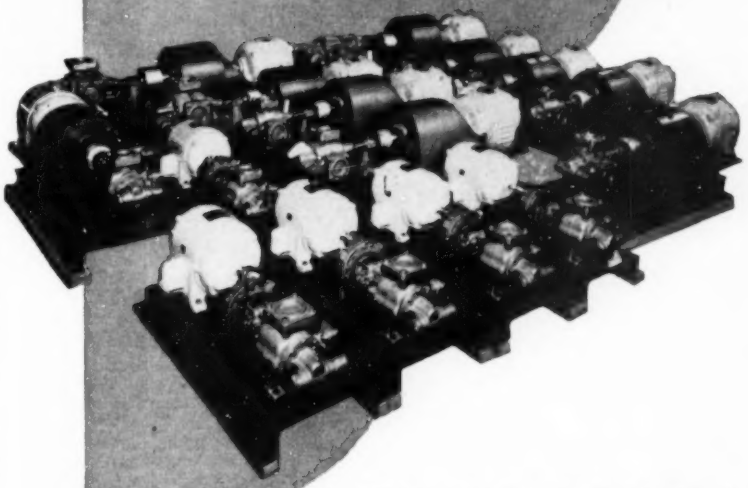
Available in ⅛-in to 2-in pipe sizes, the breather utilizes elements in steel, aluminum or monel metal, according to specification. Extra heavy-duty construction units are also available.

Cascade Control Relay System

A device for the completely automatic control of cascade ratio systems is under development by the Industrial Div. of Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa. Called an adjustable-ratio relay, the self-contained unit is a pneumatically set mul-

ROPER

fills a BIG ORDER... for a BIG PROCESSING INSTALLATION



Big order, yes! And the BIG factor that prompted the selection of the fifteen Roper Series 3600 Pumps shown was *dependability*.

Dependability as only painstaking engineering, quality components, and accurate assembly can bring.

Dependability that serves your interests on both long and short runs whether handling thick or thin liquids.

Roper Series 3600 Pumps feature hardened helical gears running in axial hydraulic balance, high lead bronze bearings, split ring packings and split gland, and adjustable relief valve . . . are made in 40 to 300 G.P.M. sizes — pressures to 60 P.S.I. Send today for Catalog 953 giving complete data on Roper pumps, or see your Roper distributor.

ROPER Rotary Pumps

GEO. D. ROPER CORPORATION
170 BLACKHAWK PARK AVENUE, ROCKFORD, ILLINOIS

tiplier which automatically controls the output of two ingredients in relation to the desired quality of their product and assures perfect proportions when they combine.

Intended to bring completely automatic control to any cascade system calling for precise regulation of two related variables with respect to a third, the company expects its use particularly in such industries as refining, distilling and chemical processing. Application is expected to various combinations of temperature, rate of flow, pressure, viscosity, pH, etc., provided the measurements can be translated into pneumatic signals.

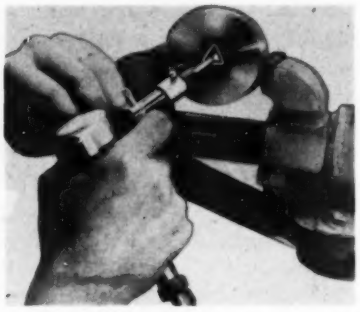
Instant-Change Safety Vise

An instant-change safety vise designed for fast setups on production pieces and featuring a fast ratchet jaw has been produced by the American Machine & Foundry Co., 511 Fifth Ave., New York 17, N. Y.

The new model has three bosses for easy jig attachment. Any number of holes can be drilled, it is claimed, without removing the work since the vise turns over on three sides for drilling flexibility. Vise locks by a quarter turn of the handle, at any position on the table. A choice of 9-in or 12-in jaw opening is offered.

Working Carbide Dies

Nord International Corp., P. O. Box 44-N34, Denville, N. J., announces a new tool, the De-Profiler, which can be used to repair, alter, and even produce tungsten carbide dies. Operation is said to be vibrationless even when used at long stroke. Action is reciprocating and oscillating at will and, when used with the spindle attachment, finely controlled rotary action is also obtained.



For repairing or working carbide dies a wide variety of diamond files are available from the company. Special stone-holding fixtures are also available for other work. A 52-page catalog covering techniques is included with purchase.

New Literature

Flexible Metal Hose Catalog

Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J., has published a new catalog illustrating and describing its helically-wound flexible metal hose and corrugated flexible metal hose. Also contained is information for ordering metal conduit and ferrules, hose assemblies, ignition shielding and components for reciprocating engines, bendable pipe, and high and low frequency leads.

Featured in the engineering data section are charts showing frictional losses *vs.* flow rates for various sizes of metal hose and conduit. Also included is information on installation and maintenance of metal hose. A completely illustrated story shows how seamed metal hose is manufactured from metal strip to complete assembly.

It's the "Combustion-Wise" Diesel Buyer who saves money today!
When buying a diesel... size, weight, capacity and initial cost are important factors to consider.
But the really smart diesel buyer, with an eye on his profit statement, also considers *operating costs*. That's why more and more diesel buyers are becoming "combustion-wise" and specifying diesels that use the Lanova combustion chamber design. They know that the higher combustion efficiencies of the Lanova System mean "more miles per gallon" and better fuel economy.
The Lanova combustion system boosts operating efficiency two ways. First, it provides a high degree of turbulence in the main combustion chamber, which insures more thorough mixing of fuel with the air needed to support combustion. Second, it *controls* and *times* the application of pressures to the piston thus providing a longer, more effective thrust during the power stroke.
Cutaway view showing a typical Lanova combustion system design. The Lanova design is used in many leading makes of diesels today. We'll be glad to send you the list.
Write for the Lanova Handbook
This valuable basic textbook on diesel engineering tells the whole combustion story – write for your free copy.
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LANOVA CORPORATION
38-19 30th Street, Long Island City 1, N. Y.
One of America's foremost names in diesel research and development

Lathe Training Films

South Bend Lathe Works, 425 E. Madison St., South Bend 22, Ind., has issued a series of three 16-mm sound films in full color for training lathe operators. The films are supplied on free loan to industrial firms and educational institutions and offer French and Spanish dialogue as well as English.

"The Metalworking Lathe", the first film, introduces the lathe to the beginer. Basic lathe parts and operations are presented. The second, "Plain Turning", shows all operations necessary to machine a shaft. The third film, "Grinding Cutter Bits", portrays the correct way to grind tools for different lathe operations. Showing time for each film is approximately 20 min.

Hose Safety Booklet

"Dangers Under Pressure" is the title of a new safety booklet being distributed by Hose Accessories Co., 2700 N. 17 St., Philadelphia 32, Pa., prepared for the benefit of hose users as an aid in securing trouble-free service life of hose and couplings and to help avoid serious accidents.

The company urges every hose user to write for a copy since many do not fully realize how dangerous air, gas, or steam are to handle. A hot ember burning through welding hose line can cause terrific explosions. Care must be employed in proper selection of hose couplings since improper attaching of couplings to hose, or misapplication, are frequent causes of accidents or costly delays.

Diesel-Powered Tractors

A new catalog issued by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., presents the four diesel-powered crawler tractors of the company in a unique way. Details of construction of each model are shown with full cutaway pictures and variety of application of each on the job. As the pages are turned, a spread of the cross-sectional views is revealed. When completely opened, the four tractors in cross-section are on view. The back then becomes mainly pictorial. To set the pace, a frame is die-cut in the lower right hand corner of the first page to provide a three-dimensional effect.

Handbook of Noise Measurement

General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass., is making available copies of its "Handbook of Noise Measurement" at a price of $1 each. The book contains over 100 pages and covers the measurement of airborne sounds including definitions, standards, measuring equipment, procedures, and interpretation of results. The authors, Dr. A. P. G. Peterson of the company's engineering staff, and Dr. Leo L. Beranek of M.I.T., are well known in the field of acoustic measurement.

Stainless Steel Electrodes

Alloy Rods Co., York, Pa., has just released a 20-page catalog on its complete line of Arcaloy stainless steel electrodes. Included in the catalog are: explanations of the two basic types offered—lime coating for all-position welding with DC reverse polarity, and AC-DC for welding of chrome-nickel steels with all types of welding equipment; individual descriptions of the 23 regular analyses of the electrodes; weld metal properties; color charts; current ranges; and AISI type numbers.

TAKE THE BULL BY THE HORNS
Yes, take the bull by the horns and *make sure* you're getting DEPENDABLE compressed air supply. Quincy Compressors really deliver — and that's no bull. They're modern . . . compact . . . rugged . . . reliable.
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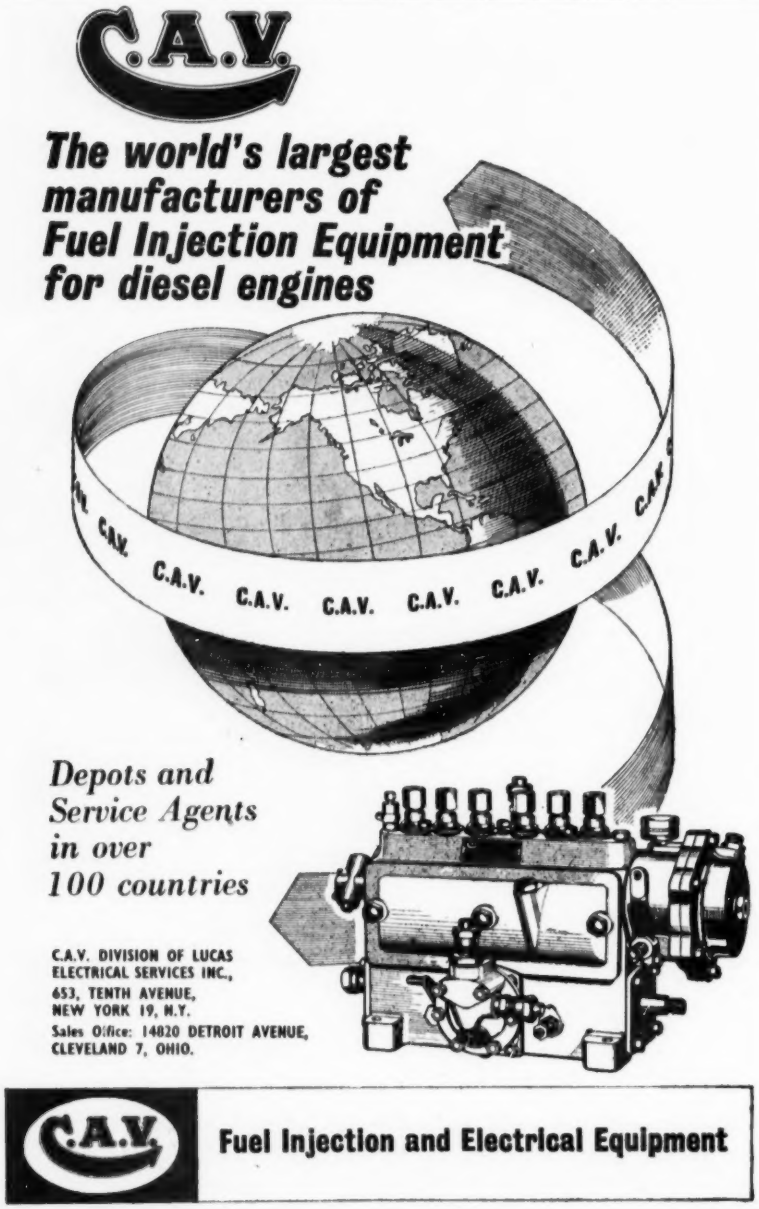
Meehanite Castings

Meehanite, a family of irons distinguished from other gray iron, is described in an 8-page folder published by the American Brake Shoe Co., 230 Park Ave., New York 17, N. Y. The booklet lists characteristics and properties of the material and carries engineering information on hardenability, section strength, and comparative properties of other cast metals. Typical applications such as for crankshafts, camshafts, and pump case for diesel use are pictured and a table of standard bar stock sizes is included.

Sound Signals Guide Book

A combination manual, data book, and catalog of sound signals has just been issued by Benjamin Electric Mfg. Co., Des Plaines, Ill. Offered as a guide to plant officials on latest methods employed, it gives scientific information on which to base selection for one, two, or complete signal systems. Areas covered include fundamentals of sound, glossary of signal and sound terms, comparison guide for selection, suggested steps in choosing an installation, and hints for compiling a coding signal call system.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Maintenance Control System

A new 8-page booklet has been published by Remington Rand Inc., 315 Fourth Ave., New York 10, N. Y., entitled "Assured Equipment Productivity through Maintenance Management". The system, developed by the company to assist in performing the functions of repair, construction, and preventive programs at satisfactory cost, lists in detail five requirements: (1) the written work order; (2) scheduled work; (3) equipment records; (4) stores control; (5) executive reports. A flow chart is featured, showing correct steps in planning and scheduling of maintenance work and recommending tools needed for establishment of a maintenance control system.

New Murphy Diesel Booklet

A new 48-page booklet giving detailed descriptions of engineering design features is being offered by Murphy Diesel Co., 5317 W. Burnham St., Milwaukee 14, Wis. Ratings and descriptions of models are presented along with 19 pages of photographs of typical installations.

GM Engineering Journal

Publication of a magazine to present General Motors' technical developments to educators and engineering college students was announced recently. The new publication will be known as the "GM Engineering Journal". It will appear bi-monthly during the school year and once during the midsummer months. Contents will include signed articles by GM engineers in virtually every field of engineering. The material will be designed to assist college instructors to supplement their classroom presentations with latest data about the application of their particular subjects.

Index of Instrumentation

More than 300 technical case histories and general information articles on industrial instrumentation are listed in a special alphabetical index just published by the Industrial Div. of Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44, Pa. The index covers instrumentation and control applications in various industries including steel, petroleum, public utility, metal finishing, and research.

Permutit Ion Exchangers

To summarize the properties of most of its ion exchangers and indicate some of their uses, a 12-page bulletin has been prepared by the Permutit Co., 330 W. 42 St., New York 36, N. Y.

The bulletin details a general history of ion exchange engineering. It gives data on the proper selection of ion exchangers, and lists general applications in the treatment of water and special problems associated with the recovery of valuable metals from solutions, streptomycin purification, sugar refining, separation of rare earths, treatment of waste, etc.

Fork Lift Fact Book

A driver's-eye-view of the operation, construction, and servicing features of its FT series fork lift trucks, plus a complete presentation of its entire materials handling line, is offered by the Buda Co., Harvey, Ill., in a new fork lift truck fact book.

A photo sequence borrows the technique of the automotive industry to spotlight basic operating features and to emphasize improvements. These include pushbutton starting, single-lever gear shifting, an easily adjustable parking brake, uncluttered floorboard, and an automotive-type frame. Similar closeups are accorded construction features.

Marion Movie on 191-M Shovel

Marion Power Shovel Co., Marion, Ohio, announces a 16-mm color-sound film on its new 191-M shovel. The movie is 12½-min long and was filmed during the construction of two large dams in the Midwest.

Industrial Regional Development

Arthur D. Little, Inc., Cambridge 42, Mass., has issued a folder describing its long experience in combining economics and technology for industrial development purposes. Surveys of resources and industrial environment, plus subsequent selection of industrial opportunities, are described in the folder.

Torque-Limiting Clutches

An illustrated engineering data sheet describing the new line of its torque-limiting slip-type friction clutches which function as automatic shear pin mechanisms, is now available from Morse Chain Co., 7601 Central Ave., Detroit 10, Mich. The data sheet includes dimensions and capacities.

Flaw Location Booklet

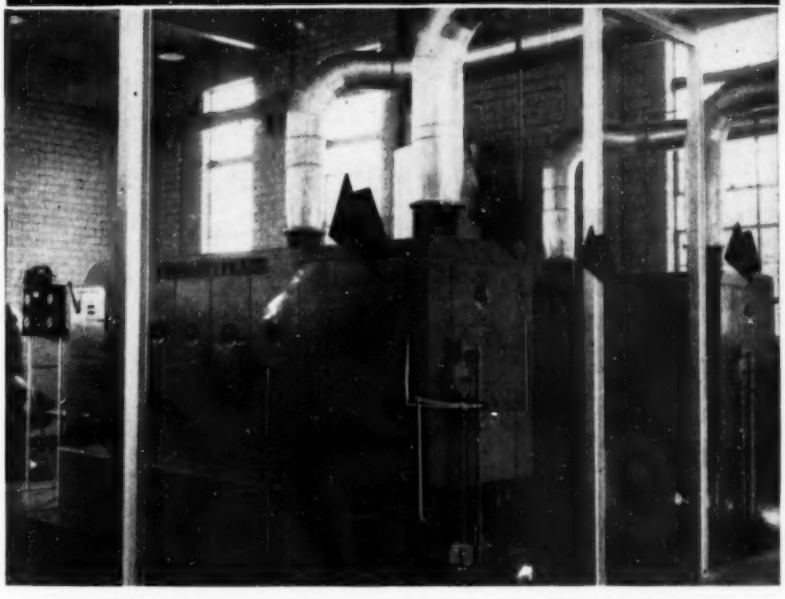
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Cal., has issued a new flaw location booklet outlining the applications of its Dy-Check method for locating hidden flaws in welds, castings, forgings, etc. The booklet is illustrated with application photos.

Heat Transfer News

Young Radiator Co., 709 S. Marquette St., Racine, Wis., is issuing a new 2-color external house organ entitled "Young Heat Transfer News". Subjects of installations include pictorial and editorial presentation of aeronautical, automotive, oil field, heavy industrial, municipal, and chemical process cooling equipment. The new organ will be published bimonthly and is offered free of charge.

Protect Rigid Piping and Exhaust Manifolds with

CMH Diesel Exhaust Connectors



The CMH Exhaust Connector is a corrugated steel tube designed to dampen exhaust line vibration. By absorbing this ever present motion, the exhaust connector protects and greatly lengthens the service life of rigid exhaust piping and helps prevent fatigue cracking of engine parts. Its protective action prolongs diesel life, reduces maintenance and assures cleaner engine room air.

The CMH Exhaust Connector is low in first cost and easy to install. It can be screwed, welded or flanged into any diesel exhaust line. Sizes range from 1" to 24" I. D. inclusive. For complete information, write for catalog 124.

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Manufacturers of flexible metal hose and conduit, expansion joints, metallic bellows and assemblies of these components.

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WESTON
all-metal THERMOMETERS
Although WESTON provides sensing elements of various forms for special applications, the element in all standard WESTON Industrial Thermometers is a *multiple helix* as illustrated above. Why the more costly *multiple*, instead of the single, helix? *Just one reason.* WESTON's twenty years experience producing bi-metal thermometers for industry has furnished convincing proof that the shorter, non-sagging *multiple* helix provides better accuracy, over longer periods. And while it provides other advantages, the one thing most thermometer buyers demand is long-term dependability. You get it, in extra measure, in WESTON Thermometers with *multiple* helix. WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.
Stocked by leading Distributors
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What Do You Know!

(*Answers to questions on Page 49*)

1. Correct answer is "b". As misalignment increases, coupling heat also increases indicating greater power losses. See article on Page 56 for details.

2. "e" is the only function that does not apply. Universal joints are designed to cope with considerable angular misalignment beyond the intent of flexible couplings. See article referred to above.

3. Correct answer is "b". It is equally important to keep contaminants out. For more details see the article mentioned above.

4. Correct answer is "c". The term applies to an engine without connecting rods and crankshaft. For an explanation see the article on Page 42.

5. "a" is correct answer. Diesels have proved this as does the free-piston engine as discussed in article mentioned above.

6. Correct answer is "a". Proper cleaning of nozzle tips with emphasis on care of the orifices is discussed in the article on Page 65.

7. "c" is correct. The increase in dirt formation in the engine due to use of heavy fuel imposes a greater load on the filters. See article on Page 46.

8. Correct answer is "b". Filters can only be expected to cope with current dirt production and should not be exected to do the job of a batch purifcation system. See article referred to above.

9. "d" is correct answer. The switcher went into service on the Jersey Central in October, 1925. More details are given in the article on Page 62.

10. Correct answer is "b". Commuter service, concentrated twice daily, places a premium on carefully planned utilization. See article mentioned above.

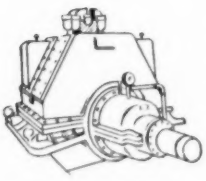
for faster shifting... increased maneuverability

You can always depend on S-N MARINE GEARS...

That's what Earl Harvey, Superintendent of the Saint John Tug Boat Company in New Brunswick, thinks about the **unmatched maneuverability** of the Model 5996 S-N Heavy Duty **in-line reverse-reduction gear.**

"For the past year," says Mr. Harvey, "the 'Ocean Hawk II'" — which is powered with a G M C Cleveland 12-567 engine — "was employed on a dredging contract towing the dump barges, and 30% of this time was taken up maneuvering ahead and astern. Under these conditions we have found your gears to be very satisfactory."

Designed to meet the high (1000 H. P.) horsepower requirements of ocean going tugs, the Model 5996 S-N gear is mounted independently from the engine and driven through a flexible coupling for smooth, quiet operation. Because the design permits shifting in **up to 50% less time than is possible** with other gears — **speed of maneuverability,** always an important factor in harbor work, has been greatly increased.



S-N Marine Gears are designed specifically for Marine Engines 4 to 1000 H. P. with a wide range of reduction gear ratios.

S-N Manual — Hydraulic — Air Operated Gears

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Transmission Engineers

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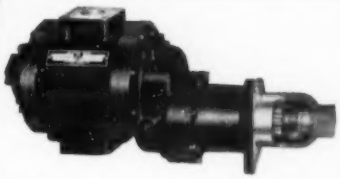
you can rely on Leece-Neville AIR Cranking Motors



Where there is danger of fire or explosion, Leece-Neville Air Cranking Motors will start diesel, gas or gasoline engines with complete safety. Whether air cranking is preferred for safety or other reasons, you can rely on an L-N Air Motor for ample cranking power regardless of low temperature or infrequent use.

Model shown is rated at 25 HP nominal at 100 p.s.i.

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AC-DC Alternator Systems • DC Generators • Starting Motors • Regulators • Switches • Small Motors • Air Starters

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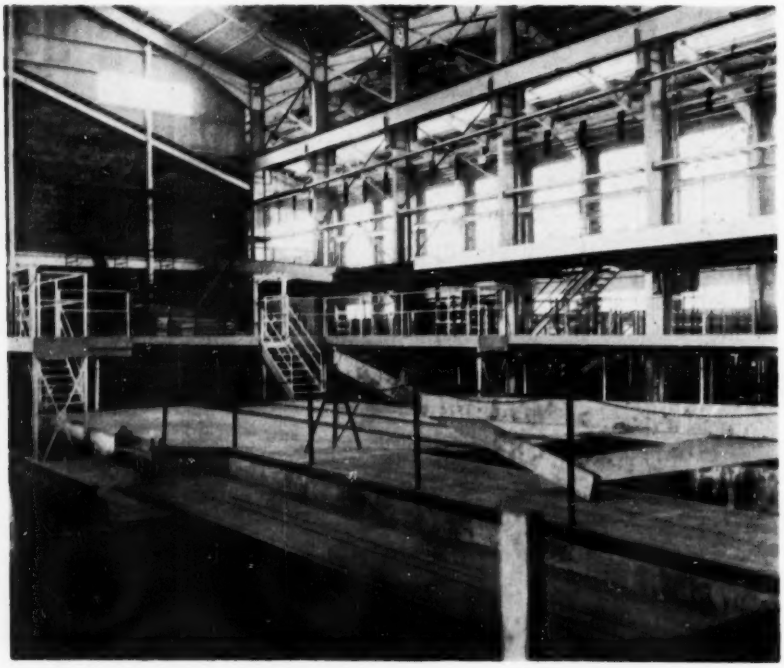

Standardized Building for Locomotive Repairs

Working in conjunction with railroad engineers, the Luria Engineering Company has developed standardized diesel locomotive service and repair shop buildings. Largest of these to be erected for any railroad to date, is the diesel repair and service shop on the New York Central System at Mino (East Syracuse), N. Y. This shop, one of four standardized diesel repair shops erected for NYC, is scheduled to go into full operation sometime in August.

The main portion of the building has two 77-ft clear-span bays. One is 243-ft long and will be used for servicing locomotives. It has three through tracks. The other is for heavy repairs, has three stub-end tracks, and is 143-ft long.

A 5-ton traveling crane will serve the 243-ft portion, while the latter 143-ft section will be served by a 30-ton overhead crane. Both sections have elevated, cab-floor height and depressed working levels flanking track pits. Working platforms consist of concrete slabs supported on steel beams and columns. Interior floor space is 43,300 sq ft.

Insect Stabber Developed

Chicago and North Western Railway is experimenting with a new type of box car insulation designed for the shipment of food products which often attract insects. Fiber glass wool is used to line the box car, the fiber presenting a forest of razor sharp swords so minute that their sharpness cannot be seen by the naked eye. An insect attempting to move about in the wool is literally stabbed to death.

LMOA to Hold Annual Meeting

The official program of the Locomotive Maintenance Officers' Assn. for the 1953 annual meeting has just been released. The meeting will take place at the Hotel Sherman, Chicago, September 14-16.

The first day will include an address by D. S. Neuhart of Union Pacific on "Gas Turbine Locomotive Maintenance and Operation", a discussion of "Methods Used to Train Personnel for Maintaining Diesel Locomotives", and a meeting of the diesel-electrical committee whose subject will be "Flashovers—Rewiring Diesel Locomotives".

The second day will contain a discussion by the shop practices committee on the subject, "Inspection and Maintenance of Diesel Wheels, Axles and Roller Bearings". Conducted tours will be held of diesel locomotive maintenance industries.

The last day will see discussions of "Scheduling and Flow of Work in Centralized Diesel Shop"; "Diesel Engine Lubrication Maintenance Problems"; and, "Economical Reclamation of Diesel Locomotive Parts".

NBS Studies Autoignition

As the compression ratios of modern gasoline engines are continually raised, increasing difficulty is being caused by knock and preignition. The rapidly expanding use of diesel engines has also emphasized problems of cold starting and engine roughness and smoking under heavy-load operation. All these difficulties are associated with the combustion phenomenon known as "autoignition" which occurs when a fuel-air mixture is heated by compression until it ignites spontaneously without spark.

Seeking information that will lead to more efficient utilization of fuels, W. J. Levedahl and C. R. Yokley of the National Bureau of Standards' engine fuels laboratory have been conducting an intensive investigation of autoignition. Their appartus includes a special single-cylinder engine of variable compression ratio in which a wide range of operating conditions may be simulated. The engine has been modified to permit the compression-ignition of a single homogenous premixed charge of fuel and air in the absence of burned residual gases, cylinder hot spots, and lubricating oil.

Pressure, rate of change of pressure, and light emission are oscillographically recorded as functions of crank angle or time. At any preselected time during the course of the reaction a

special sampling valve developed by NBS is used to remove a sample from the reacting mixture during an interval of about 0.2 to 0.3 millisecond. Use of this valve enables the reaction to be followed by mass spectrometric means, as suggested by Dr. E. U. Condon.

Experiments have been carried out on a number of hydrocarbon fuels of various chemical structures. In general, it has been found that autoignition of a paraffinic hydrocarbon occurs in a series of steps. First reaction is formation of peroxides. At higher temperatures a blue luminescence called the "cool flame" appears. When temperature rises to about 1100° F. rate of reaction increases rapidly as the "hot flame" appears. Accompanying violent pressure rise causes a pressure wave back and forth across the combustion space, causing audible knock.

Investigation of many pure hydrocarbons, isooctane-*n*-heptane blends, and oxygen-containing compounds has shown that as octane number and resistance to autoignition increase, temperatures at which peroxides and cool flames are first detected also increase while amount of heat released during cool flame decreases. Over a wide range of fuel-air ratios, however, temperature at which hot flames appear lie in the same range for all aliphatic compounds studied.

Capital Goods Export Market

A recent Council for Technological Advancement survey emphasizes the rapidly growing interest in foreign markets and confirms the high proportion of foreign to total sales. It is also made evident that capital goods manufacturers have a major potentiality in foreign trade with less-developed countries as contrasted with highly industrialized and competitive countries.

Machinery and equipment comprises the largest group of commodities exported (25 per cent of non-military exports). During the past few years about 11 or 12 per cent of total machinery and equipment sales ranged from 4 per cent for railroad and transit equipment to almost 23 per cent for tractors, parts and accessories.

Major trends seem to be that exports are currently declining from the record levels of 1952 but are still at a high level by all previous standards. The largest single capital goods export market is now Latin America which has displaced Europe in its prewar role as the largest customer.

Canadian purchases of U. S. machinery and equipment recently have shown the sharpest increase of any area. If this rate of increase is continued, Canada will in turn displace Latin America as the largest importer. Although lagging behind other marketing area, European purchases have held up well in the past two years despite tapering off of U. S. Government economic aid.

United Specialties Expands

United Specialties Co. has expanded its Chicago plant to meet increased needs of its air cleaner customers, it was announced. About $900,000 was invested in the improved facilities.

PROTECTION
FOR YOUR
ENGINE

You'll never be faced with engine damage caused by oil pressure failure or overheated cooling water IF you equip *your engines* with PENN Safety Controls.

At the first hint of lube oil pressure failure or overheated cooling water, the PENN Control snaps into action. It will sound an alarm, flash a warning light, or stop engine operation . . . *whichever you choose.* Then, you can investigate and correct the minor trouble before serious damage occurs. Thus costly engine repairs and loss of production time are avoided.

Learn more about this *low-cost* protection for new and old engines. Write **Penn Controls, Inc., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N. Y., U.S.A. In Canada: Penn Controls Limited, Toronto 13, Ontario.

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We shall be glad to demonstrate in your own diesel repair shop . . . or send you more details on request. Oakite Products, Inc., 22C Rector Street, New York 6, N. Y.

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Micromatic Buys Demco

Negotiations have been completed for the purchase of the Diesel Engineering and Manufacturing Corp. (Demco) by the Micromatic Hone Corp. No major change in the organization, policies, methods, or operating personnel, have been announced. Name of the organization will be changed to Micro-Precision Inc., a subsidiary of Micromatic Hone Corp.

Diesels Pay Off for Canada Rails

The Toronto *Financial Post* in a recent survey revealed that Canada's railways are forging ahead with their long-term programs for conversion from steam to diesel operation. In some cases, returns from new diesels have been running at a rate high enough to repay the initial capital cost in five years or less.

At present, Canadian National Railways has some 446 diesels in service representing about 15 per cent of its entire locomotive fleet. Canadian Pacific's 332 account for 17 per cent of its fleet and Algoma Central & Hudson Bay with 23 has been operating all its trains with diesels since last year.

CPR has been switching its freight and passenger service to diesels by sections. Four have already been converted, with a fifth, the Kootenay-Kettle Valley, scheduled for this year. In the latest of these, the Calgary and Revelstoke run over the steepest grades of the Rockies, the switchover was completed in 1952.

In its first full year of operation, the 60 powerful new diesel road units chopped operating costs (fuel, wages, maintenance and repairs) by a gross amount of $3.5 millions, a savings of 45 per cent. As in all conversations, the biggest cut was in fuel costs, the fuel savings alone totaling $1,850,000 or 55 per cent on this run in the first year.

Other figures given for the Schreiber division in northern Ontario revealed that in its first full year of operation on diesels, operating costs were cut by $3.7 millions (50 per cent) and fuel savings amounted to $2,250,000 or over 60 per cent. Other sections show

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Quality Precision Crankshafts For Diesels — Since 1910 . . .

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CRANKSHAFTS · CONNECTING RODS
MACHINE FORGINGS
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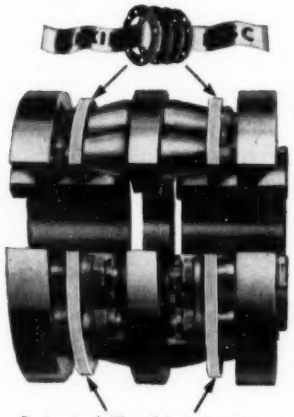
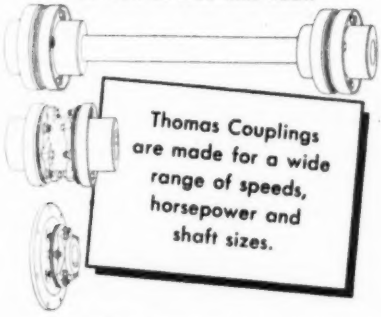
Specify THOMAS ALL METAL
FLEXIBLE COUPLINGS
for Power Transmission to avoid Costly Shut-Downs

DISTINCTIVE ADVANTAGES	
FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.



Thomas Couplings are made for a wide range of speeds, horsepower and shaft sizes.

THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT

NO MAINTENANCE PROBLEMS

ALL PARTS ARE SOLIDLY BOLTED TOGETHER

Write for our new Engineering Catalog No. 51

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

even higher results in fuel savings.

Of the CNR, president Donald Gordon said recently, "On the runs over which we now have diesels operating on through freight, we have established savings in operation that show us a return of anywhere from 30-40 per cent on our investment, so it only takes two or three years to get our capital back with this kind of savings".

Algoma Central & Hudson Bay, reporting on 1952 operations, stated that "there are now 23 diesel locomotives in service and though gross traffics have increased, transportation expenses have decreased over $270,000". In addition, maintenance of equipment was down by over $100,000 from 1951.

Thermal efficiency is given as the main reason for the diesels superiority over steam, the diesel getting about 26 per cent available power out of every pound of fuel as against 6 to 8 per cent for the steam horse. In addition, the diesel has a higher utilization factor, not being required to go off the line for servicing as often as the steam locomotive and making better time on the road due to less frequent stops for refueling.

Fuel savings over steam are highest when the diesel is starting or running at low speeds because its full horsepower is used all the time whereas the steam locomotive is only used fully at high speeds. This explains why railways have been concentrating on freight and switching service conversion. Fuel savings on switching operations normally run 70-75 per cent; on freight 60-65 per cent; and on passenger 50-55 per cent.

One of the most significant railroad statistical yardsticks is gross ton-miles per freight train hour, showing the unit output per hour of freight train operation. Last year, the figure for CNR rose from 27,593 to 29,309; for CPR to 30,503 from 28,271. Diesels were a major factor in the improvement.

Study Underground Power Cables

It may be possible to increase the power load and slow down the deterioration of underground power transmission cables as a result of research

order it . . .

install it . . .

forget it . . .

You can do that with ATLANTIC seamless diesel hose which requires no maintenance whatever.

Absolute uniformity of wall thickness . . . no seams or packed joints . . . absolutely tight against water, oil, steam, gas, air . . . dampens vibration . . . . maintains flexibility at extremely high temperatures.

Bronze, Steel, Stainless Steel, Monel — ⅛"—36" I.D. with fittings as needed.

Diesel Bulletins 1020 & 50A furnish complete information.

See our Catalogs in Sweet's Files for Product Designers and Mechanical Industries.

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METAL HOSE CO., INC.
109 West 64th St.,
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measure vibration

WITHOUT CONTACT
or "LOADING"

...also Axial or Radial Displacement to .0001"

Accurately measure and record dynamic or static displacement, plus viewing the amplitude of dynamic movement of any metal body...at any speed. Sensing unit is calibrated for direct reading. Measurements are independent of acceleration or frequency of displacement.

ALSO MEASURES:

Radial expansion due to high speeds
Travel, bounce of relay contacts
Bearing slap in motors
Shaft whip
Eccentricity of commutators, slip rings

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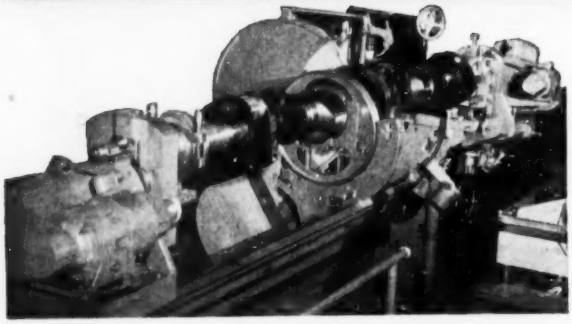
CRANKSHAFT GRINDING SERVICE



Established 1924 . . . 28 years experience grinding crankshafts! The most complete engine rebuilding shop in the Southwest!

THE LARGEST CRANKSHAFT GRINDING MACHINE IN THE WORLD USED IN AN INDEPENDENT REPAIR SHOP

★ **HARD CHROMIUM PLATING SERVICE**
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Four machines giving range from the smallest up to crankshafts with stroke of 16" and 200" O.A.L. Complete grinding service for locomotive, stationary, marine, automotive and compressor crankshafts. Undersized journals restored to size by hard chromium plating.

NATIONAL WELDING & GRINDING CO.
2929 CANTON ST. DALLAS 1, TEXAS

conducted by William A. Hadley, associate professor of mechanical engineering at Columbia University.

Using radioactive tracers, Professor Hadley is studying the migration of moisture in granular material. A critical level for the percentage of water content in the soil has been determined and below this level soil rapidly loses its heat conduction ability. By controlling the water content of soil around buried power cables, therefore, it appears likely that better efficiency can be promoted.

New Wilkening Agent

Wilkening Mfg. Co. announces the appointment of Seneca Tool Corp., New York City, as agent for the sale of Pedrick piston rings to railroads in the east central and northeastern states. Seneca Tool Corp. has been serving railroads for many years and now can offer complete engineered sets of piston rings specially developed for big-bore diesel engines.

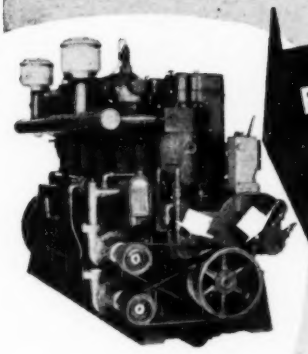
Alloy Rods Builds Western Plant

Alloy Rods Co. announces that construction has started on a new plant at El Segundo, Cal. The plant will produce a complete line of alloy arc welding electrodes to serve the Pacific Coast and Rocky Mountain states. It is expected to be in full operation by October. The present plant in York is being enlarged to double existing production facilities.

New Precision Casting Facility

The Naval Ordnance Test Station at China Lake, Cal., has installed a new precision investment casting laboratory for experimental work on complex ordnance parts.

Since prehistoric times this process has been used for creative art work and after the turn of the century for dentures and intricate costume jewelry. During World War II, it suddenly became a major industrial process for making precise turbo-supercharger buckets from a super-alloy that was very difficult to machine. Among its advantages are tolerances as small as 0.003 in per inch and the absence of a centerline on finished castings. The new laboratory will add information to the open literature, investigate additional uses for the process and work toward possible improvements.



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It Pays to Specify

TUTHILL PUMPS

For dependable lubrication of diesel engines and power units, Tuthill offers a complete line of positive displacement pumps, designed for lubricating and scavenging. Included are automatic reversing pumps and stripped models for built-in applications.

Write for the Tuthill Pump Guide listing all Tuthill Pumps for lubricating requirements. Send specifications for quotation.

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Dependable Rotary Pumps since 1927
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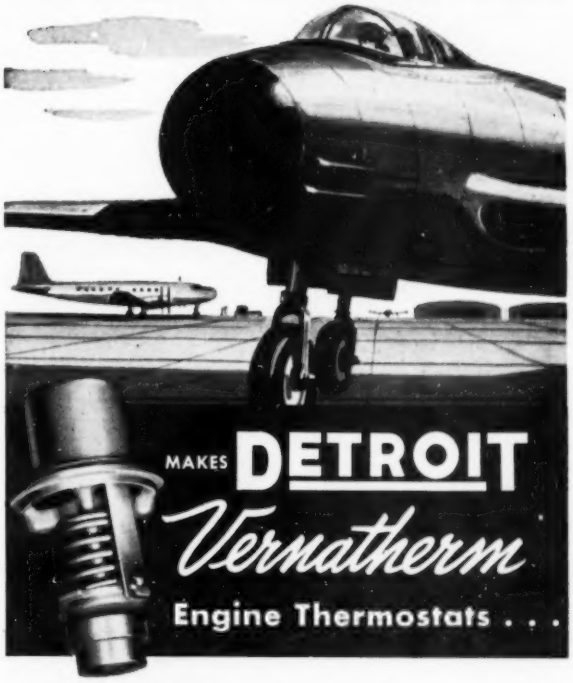

The *BEST* Choice For Your Needs

If you're concerned with the design of lubricating oil or cooling systems for jet, heavy-duty gasoline or diesel engines it will pay you to specify DETROIT Vernatherm Engine Thermostats. For only DETROIT Engine Thermostats give you the assurance of dependable, efficient operation performance proven on military and commercial aircraft . . . on ordnance combat vehicles . . . and on most diesel makes and models. So take advantage of this outstanding record—specify DETROIT Vernatherm Engine Thermostats, the true standard of the industry for rugged, exacting service! Available as engine cooling thermostats, oil cooler thermostats, shutter thermostats and thermostatic power elements.

All DETROIT Vernatherm Engine Thermostats are . . .

- *Designed to work with either open or closed cooling systems*
- *Built with tight seats for minimum leakage*
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AUTOMATIC CONTROLS for REFRIGERATION
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Serving home and industry AMERICAN-STANDARD • AMERICAN BLOWER
CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

RR Hot Box Study Continues

Completion of two unusual testing machines for research use on minimizing the occurrence of railroad freight car hot boxes was announced by the Armour Research Foundation of the Illinois Institute of Technology. The two year project is being sponsored by the Association of American Railroads.

One of the testing machines is an actual freight car truck, the assembly containing four wheels at the front or rear of a freight car, set up so that cooling, heat flow, and temperature characteristics of the journal can be studied under controlled laboratory conditions. How the bearing is cooled and how the cooling action may be improved will be investigated.

The other machine, a full-scale bearing tester, simulates the workings inside a journal box. The tester will be used in measuring frictional resistance of the bearing, fluid pressures, effects of different oils, and characteristics of waste materials used in lubrication.

Alloy Casting Institute Meets

Technical discussions at the 13th annual meeting of the Alloy Casting Institute, held recently at Hot Springs, Va., covered a variety of research subjects with especial emphasis on titanium casting techniques and the newly developed shell molding process.

The experimental production of titanium castings was discussed under leadership of J. H. Jackson, director of the Institute's research projects at Battelle Memorial Institute. Shell molding was discussed by H. J. Cooper of Cooper Alloy Foundry Co. Reports on progress of the Institute's current metallurgical and foundry research in the high temperature and corrosion fields were also given.

Refrigeration Exposition Set

Executives from metal working industries are expected to attend the Refrigeration & Air Conditioning Exposition in Cleveland, November 9-12, according to George E. Mills, show director.

"Cooling of metals with mechanical refrigeration is rapidly becoming one of the most important processes in the metal working industry," Mr. Mills stated. "Controlling the temperatures of oil and water for tempering, chilling weld tips, maintaining temperature levels in hydraulic fluids, using cooling equipment in the heat-treating of steel, freezing metals to change their structure, and maintaining close dimensional controls, are only a few of the uses of refrigeration."

The exposition is sponsored by the Refrigeration Equipment Manufacturers Association.

Aerosol Camera Developed

Stanford Research Institute announces development of an experimental camera for photographing microscopic particles floating free in the atmosphere. The camera is said to be able to photograph aerosols as small as one two-thousandths of an inch.

When fully perfected, the 500-lb camera should indicate whether or not the process of settling or precipitating particles upon a slide alters or destroys some of them, (previous technique used to examine aerosols by

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CENTRIFUGAL governors
give you exact R.P.M. control
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ENGINE INDICATOR for HIGH SPEED ENGINES

Type 4-HST Indicator is the only engine indicator available for recording a complete pressure-time diagram in a single engine cycle. The diagram is traced on paper and is large enough for detailed study.

The ruggedness, compactness and simplicity of use of the Type 4-HST Indicator recommend it particularly for test floor and field use. A wide selection of pressure springs, and convenient interchangeability of the piston with its sleeve and the spring, gives the advantage of great flexibility in the application of this indicator.

Write for Leaflet 611 which gives complete particulars.

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World's Largest Manufacturer of Engine Indicating Equipment

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Offers at LARGE SAVINGS

INTERCHANGEABLE
FACTORY NEW
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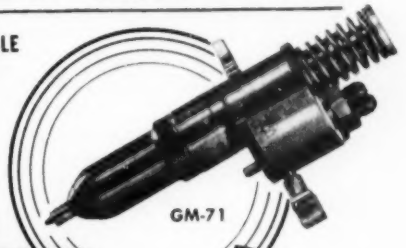

- INJECTOR & FUEL PUMP PARTS for CATERPILLAR – BOSCH G. M. & INTERNATIONAL

INJECTOR EXCHANGE with NO-RE-WORKED PARTS USED

WRITE FOR BULLETIN → G&K DIESEL SERVICE
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BOSTON, MASS.

microscope). The camera may enable scientists for the first time to follow and record the history of an unstable aerosol particle.

Study Corrosion of Low-Alloy Irons and Steels in Soils

A recent study by the National Bureau of Standards provides new information on the corrosion of certain low-alloy irons and steels in soils. Specimen plates of several of these materials (containing up to about 6 per cent of total alloying elements) together with reference specimens of plain steel, were buried at 15 different test sites for periods up to 13 years.

Included in the study were specimens of copper-molybdenum open-hearth irons, nickel-copper steels, and chromium steels with and without molybdenum. Sets of specimens were regularly removed over the 13-year period and after removal of corrosion products, the weight losses and depths of the deepest pits were measured.

It was found that the steels containing 4 to 6 per cent of chromium generally lost only about half as much weight as plain steel under the same conditions. However, the greater corrosion resistance of the alloy steels as measured by weight loss was not generally accompanied by a corresponding reduction in the maximum depth of pits. Least pitting was observed on specimens that contained molybdenum in addition to chromium.

Change in the rate of pitting with time was found to depend on the composition of the steel. Although the initial rate of pitting was greater for the alloy steels, the depths of deepest pits were usually less than in the plain steel, indicating that after the maximum period of exposure the alloying constituents induce the formation of corrosion products which tend to reduce rate of pitting with time.

In an environment unfavorable to development of protective deposits of corrosion products, the alloy steels could be expected to develop deeper pits than plain steel because the greater initial rate of pitting of the alloy steels would tend to be maintained. This tendency was observed in a few highly reducing soils in which deposition of protective scale was impossible because of the solubility of the corrosion products.

Provided their corrosion resistance in a prospective environment is sufficient, low alloy steels may be of interest for certain applications because of their high strength. The NBS study indicates that alloy steels may be appropriate choices for certain types of underground construction such as piling, in which mechanical strength rather than ability to contain a fluid indefinitely without leakage is of primary importance. However, whether the superior properties of an alloy steel justify its higher initial cost was stressed as a factor that should be given consideration.

Noise Abatement Symposium

Outdoor noise will be the topic for the 4th National Noise Abatement Symposium to be held October 23 and 24, in Chicago. It is expected to be the largest meeting ever held concerning this subject. Papers on traffic, vehicle, and other city noises as well as on urban and industrial planning for less noise are being considered for

presentation along with recent information on industrial noise.

New Amot Representative

The American Motors Co. announces the appointment of the Hudson Rush Co. as its representative for Amot thermostats for engine temperature control in northern Louisiana and northern Texas.

Organizational News

Kent-Moore Appoints

John T. Davis has been appointed advertising manager for Kent-Moore Organization, Inc., it was recently announced by J. D. Adair, president.

John T. Davis

Stanley Engineering Expands

The Stanley Engineering Co. has opened Chicago offices for the purpose of providing improved consulting engineering service to industrial clients in that area. Mr. Frank W. Edwards will be in charge of the new office. Main office will continue to be located in Muscatine, Iowa.

Permutit Plant Grows

Coincident with the completion of the Permutit Company's program for doubling the capacity of its Birmingham, N. J., works for the production of iron exchange resins, it was revealed that the company has now placed contracts for further extensions and improvements, including a new laboratory and pilot plant building to cost $200,000.

Ohio Crankshaft Elevation

The Ohio Crankshaft Co. has announced the appointment of M. J. Hoke to the post of general manager of the organization's crankshaft and camshaft division.

Mr. Hoke joined the company in 1945 as a development engineer. In

M. J. Hoke

1947 he was made chief engineer and became works manager the following year. Prior to his connection with the company he had been chief tool engineer for the Miami division of Consolidated Vultee Aircraft Corp.

Oakite Management Changes

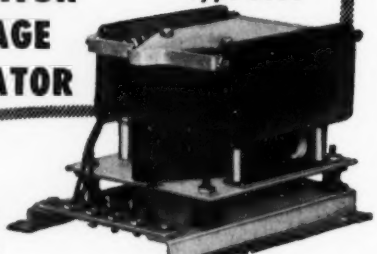
Following a meeting of the board of directors of Oakite Products, Inc., five changes in management organization of the company were announced.

H. Liggett Gray, former vice president, was elected to second vice president, in which office he will be responsible for overall management functions in addition to general supervisory duties connected with man-

Burlington

TYPE WA
Formerly
Ward-Leonard
Type 5660

GENERATOR VOLTAGE REGULATOR



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- RUGGED CONSTRUCTION
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- INEXPENSIVE

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Rating of rheostatic element is 2 amperes maximum exciter shunt field current at rated load and power factor. Maximum sigma watts is 50 watts.

Inquiries for complete information and engineering services solicited.

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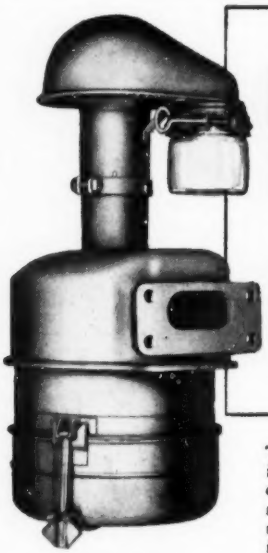

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Air Cleaners
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EASY TO SERVICE!

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CUSTOM-BUILT
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Grinnell Division: Grinnell, Iowa
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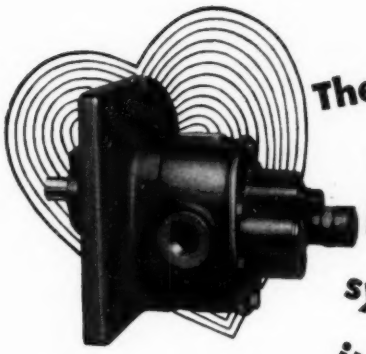

The HEART of a diesel lubricating system is its PUMP

Rotary geared pump with special flange mounting becomes integral part of diesel engine when installed. Note opening above relief valve for tachometer.

Modern diesel operation generally requires a pressure lubricating system — and the vital element is the pump. Thousands of Brown & Sharpe pumps are now providing reliable service month after month without interruption, for lubrication, transfer, or booster systems. Available with various types of flange mountings and special internal construction to meet specific requirements. Write for catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

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MODEL K-120 UNIVERSAL PEAK PRESSURE INDICATOR

For Testing Firing and Compression Pressures on all Models of Diesel and Gas Engines. Dependable — Rugged. May be Used With or Without Flexible Tube.

MODEL K-120 Indicator has but one moving part — nothing to wear or get out of adjustment.

VALVE — Gas trap type with diaphragm type check valve having adjustable lift. Stainless steel valve and seat.

No springs — No pistons — no complicated adjustments — No temperature corrections — no pressure loss in check valve.

GAGE READS TRUE PRESSURE — MAY BE RECALIBRATED ON ANY GAGE TESTER

Check readings can be made over and over again by releasing indicated pressures with bleeder valve.

ADAPTORS available for most models of engines manufactured in U. S. A. Other models made to order at reasonable prices.

KIENE DIESEL ACCESSORIES, INC.

10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

ufacturing operations. Frank Oldroyd was named vice president, a post he will hold in addition to his present position as general sales manager of the industrial division.

Eustace Lingle becomes vice president and will be responsible for the functioning of the firm's engineering, technical service, and sales development departments. Van Dorn C. Smith, another vice president, will undertake consultation work of a general technical and sales nature. Another change is the election of George M. Seib, assistant manager, to secretary of the company, who will also continue to supervise personnel department operations and general office administration procedures.

Socony-Vacuum Promotions

Several personnel changes in the research and development department of Socony-Vacuum Oil Co., Inc. at Paulsboro, N. J., have been announced.

T. A. Petry has been named a supervisor in the development division; H. E. Rasmussen now is assistant supervisor of the refining section; D. P. Heath will be assistant supervisor of the fuels and lubricants section; and R. R. Halik and L. M. Browning become research associates in the process development section.

Cleveland Diesel Advancements

Two changes have occurred in the eastern area sales office of the Cleveland Diesel Engine Div. of General Motors Corp. Charles G. Gustavson has been named regional sales manager of the New York office and Edward H. Davis joins him as assistant regional sales manager.

Mr. Gustavson became associated with a predecessor of the division, Winton Engine Co., in 1926 as service engineer. In 1930 he was made marine superintendent and held this post until 1946 when he became assistant eastern sales manager. Mr. Davis joined the division in 1946 as a sales engineer, holding that position until his recent appointment.

C. G. Gustavson

E. H. Davis

Borg-Warner Assignments

A. W. Rose has been appointed Pacific Coast representative of Borg-Warner Corp., resigning as vice president and assistant general manager of the Warner Gear Div. to take the post. A. P. Emmert, former president of the Warner Gear Div., has accepted the general managership of the Detroit Gear Div.

Mr. Rose will establish his office in Los Angeles. He joined Warner Gear in 1931 and was appointed assistant general manager in 1951, becoming vice president in 1952. Mr. Emmert resigned from the presidency of Warner Gear last year because of ill health. He will succeed A. J. McAllister who has retired from Detroit Gear. He has served Warner Gear for 25 years, the last 8 years as president.

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BRODIE SYSTEM

AN ENGINEERING SERVICE

Shafts brought to standard sizes—
no need for undersize bearings

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- METALLIZING

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LARGEST CRANKSHAFT GRINDER IN A JOBBING SHOP

New Shell Oil Secretary

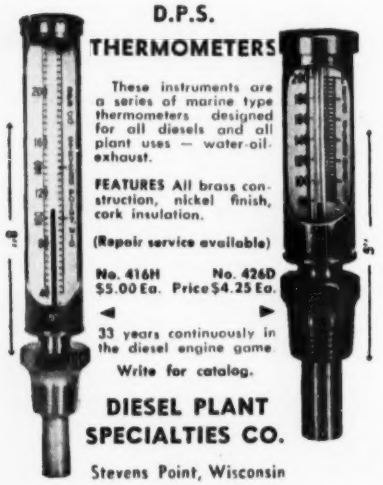
J. A. Horner has been appointed secretary of the Shell Oil Company to succeed F. W. Woods who has retired. He was formerly administrative assistant to the president and assistant secretary.

Baldwin-Lima-Hamilton Manager

E. H. Schoonmaker has been appointed to the post of district manager of the St. Louis, Mo. district sales office for the Eddystone Div. of Baldwin-Lima-Hamilton Corp. Previous to this, he was acting manager of the district.

New National Carbon Manager

J. R. Johnstone has been advanced to the position of manager of the Carbon Product Sales Dept. of the National Carbon Co., a division of Union Carbide and Carbon Corp. He has been with the company since 1937 and was engaged in various sales and administrative functions before being given his present assignment.



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THERMOMETERS

These instruments are a series of marine type thermometers designed for all diesels and all plant uses — water-oil-exhaust.

FEATURES All brass construction, nickel finish, cork insulation.

(Repair service available)

No. 416H $5.00 Ea. Price No. 426D $4.25 Ea.

33 years continuously in the diesel engine game

Write for catalog.

DIESEL PLANT SPECIALTIES CO.

Stevens Point, Wisconsin

Eaton Elevates Three

The Eaton Mfg. Co. announces the promotion of M. D. Archangeli to general sales manager, Valve and Saginaw Divs.; J. R. Stearns to sales manager, Valve Div.; and J. R. Harrison to sales manager, Saginaw Div.

Mr. Archangeli joined the company in 1919. In 1939 he was made sales manager of the Saginaw Div. and in 1947 sales manager of both the Saginaw and Valve Divs. Mr. Stearns became a member of the company in 1933. He became assistant sales manager of the Valve Div. in 1947. Mr. Harrison started with the company in 1931. In 1937 he was made sales representative for the Saginaw Div. and in 1947 assistant sales manager.

Federal-Mogul Manager Dies

Don H. Herr, manager of Federal-Mogul Corp.'s central service warehouse in Coldwater, Mich., and a prominent figure in the automotive industry for more than 40 years, died recently at the age of 63. Mr. Herr had been with the company since 1945, when he joined to head the Coldwater operations. Robert G. White has been named his successor.

Dan H. Herr

Santa Fe Appoints Engineer

Frank N. Barker, Illinois chief highway engineer, has been appointed assistant chief engineer of the Santa Fe Railway System effective September 1, it was announced. He will headquarter in Chicago.

Frontier Names Ad Director

Frontier Industries, Inc., announces the appointment of William B. Tanner as director of advertising. He will make his headquarters at the Manzel Div. of the company and will also handle advertising for the Fairmount subsidiary. He was formerly director of advertising of the Aerovox Corp. and its subsidiaries.

Chief Engineer's position wanted. Experienced on Diesels with light and heavy fuels. Also unlimited licenses in Mass., New Jersey and Philadelphia for boilers, engines and turbines. Industrial plant or Central Station. Write to Box 800.

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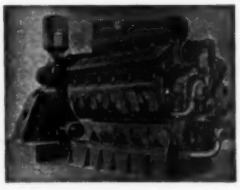
Unit Capacities 100 to 1875 Kva A.C. 50-60 Cycles Various Voltages



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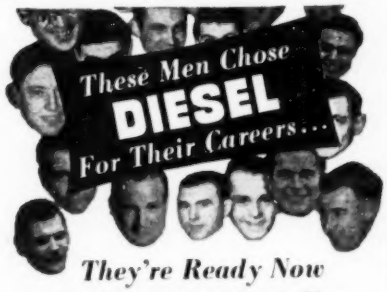

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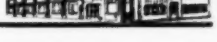

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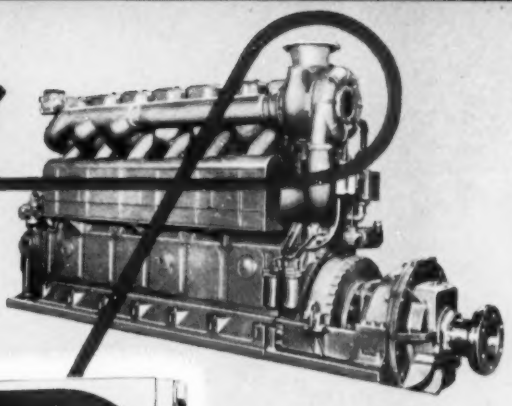

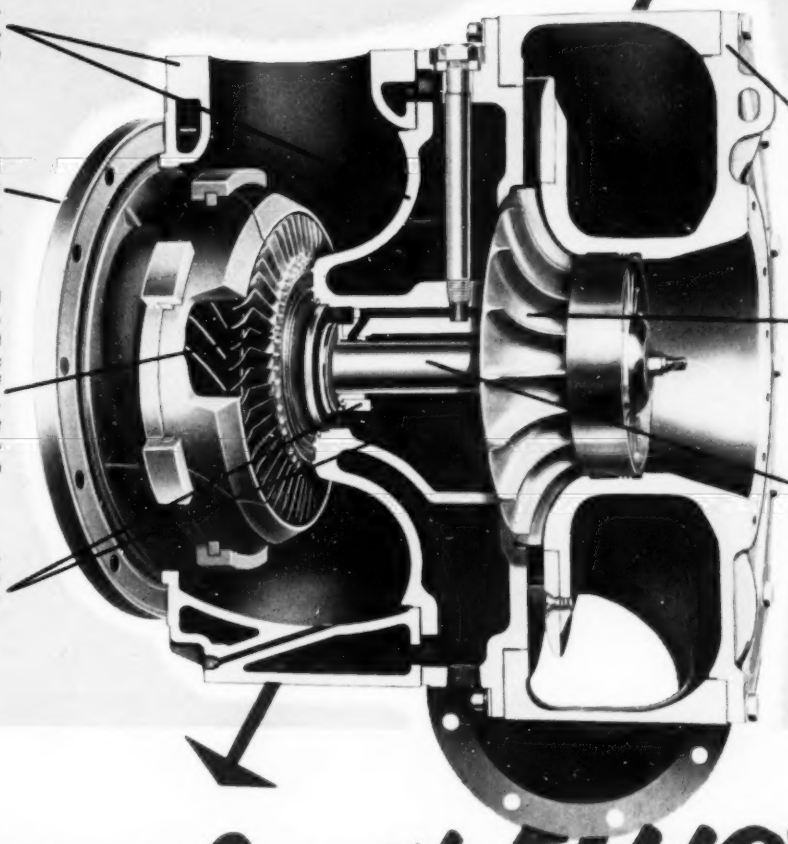

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